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Opuscula Philolichenum

small works in the field of lichenology

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Opuscula Philolichenum is intended to serve as a venue for the publication of small works in the field of lichenology (including lichenicolous fungi and non-lichenized fungi traditionally treated with lichens). The journal is primarily electronic, available on-line free of charge (at http://sweetgum.nybg.org/philolichenum/), with a limited print run to satisfy the requirements for effective publication established under the *International Code for Botanical Nomenclature*.

The central goal of the journal is to provide timely publication, in a professional format, free of charge to authors and readers. While the journal focuses on topics relating to the lichen biota of North America this is by no means exclusive and manuscripts on other topics will be considered as the table of contents of the present issue clearly illustrates.

Authors wishing to submit a manuscript for publication in *Opuscula Philolichenum* should contact the editor prior to submission to confirm that the paper conforms to the mission of the journal (outlined above). Manuscript submissions ***should be left unformatted*** and authors should consult a recent issue of *Opuscula Philolichenum* for style. All submissions are subjected to review by at least two peer reviewers and, following acceptance are formatted by the editor.

As has been noted in the preface to previous issues the backbone of any scientific journal is its cohort of reviewers. As such the editor would like to take this opportunity to thank those who graciously provided peer review of manuscripts published in this volume: Irwin Brodo, Viclor Catalayud, Stephan Clayden, Paul Diederich, Theodore Esslinger, Javier Etayo, Claudia Hanel, Richard Harris, James Hinds, Brendan Hodkinson, Martin Kukwa, Douglas Ladd, Phil May, Caleb Morse, Christian Printzen, Michaela Schmull, Tor Tønsberg, Dagmar Triebel, Shirley Tucker, and Ulf Arup. The editor also extends his sincerest thanks to the associate editors whose efforts in editing and proofing manuscripts, soliciting manuscripts, and corresponding with authors have greatly improved the quality of the journal. Thanks also to Brendan Hodkinson and Melissa Tulig for their help with the online presence of this journal.

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A brief lichen foray in the Mount Washington alpine zone – including *Claurouxia chalybeioides*, *Porina norrlinii* and *Stereocaulon leucophaeopsis* new to North America

ALAN M. FRYDAY[1]

ABSTRACT. – A preliminary investigation of the lichen biota of Mt. Washington (New Hampshire) is presented based on two days spent on the mountain in August 2008. *Claurouxia chalybeioides*, *Porina norrlinii* and *Stereocaulon leucophaeopsis* are reported for the first time from North America and *Frutidella caesioatra* is reported for the first time from the United States. A full list of the species recorded during the visit is also presented.

INTRODUCTION

Mt. Washington, at 1918 m, is the highest peak in northeast North America and has the most alpine tundra of any site in the eastern United States. In spite of this, its lichen biota is very poorly documented with the only published accounts to specifically mention Mt. Washington or the White Mountains by name obtained from the Recent Literature on Lichens web-site (Culberson et al. 2009), which includes all lichenological references since 1536, being an early work by Farlow (1884), and the ecological work by Bliss (1963, 1966), which included a few macrolichens. However, the mountain was a favorite destination of Edward Tuckerman and many records can be extracted from his published taxonomic works (e.g., Tuckerman 1845, 1847, 1882, 1888). More recently Richard Harris and William Buck of the New York Botanical Garden, and Clifford Wetmore of the University of Minnesota have collected lichens on the mountain. Their records have not been published, although the report Wetmore produced for the U.S. Forest Service is available online (Wetmore 1989). Wetmore lists the species he recorded, along with an extensive literature list and a list of species reported from the White Mountains in the literature. Wetmore concentrated his survey on the Presidential Dry River and the Great Gulf Wilderness Areas but, unfortunately, it is not possible from his report to determine from where in these areas the species he reported were collected.

Here I report on a brief visit to the alpine zone of Mt. Washington in 2008. The first day (August 24) was organized as a guided walk for the Friends of the Farlow Herbarium, whereas the second (August 27) was a solo visit by the author. Both started from the summit. Unless otherwise stated all collections were made by the author and are deposited in the herbarium of Michigan State University (MSC). Species marked with an asterisk (*) are dealt with in the "Notes on Species Recorded" section

THE LICHEN BIOTA

The first day was mostly spent investigated the boulder field west of the summit. Most records were from either the large boulders or small, loose pebbles between them. Among the species recorded here were *Cladonia luteoalba**, *Clauzadeana macula, Lecanora chlorophaeoides**, *Lecanora placidensis, Micarea marginata**, *Rhizocarpon anaperum**, *R. intersitum**, *Schaereria cinereorufa, Stereocaulon leucophaeopsis** (first NA report) and *S. nanodes.*

It was interesting to note that small pebbles among the boulders supported similar lichen species to small pebbles in areas affected by late snow-lie on Katahdin (Maine) but that *Stereocaulon*

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tornense/plicatile, which is frequent on Katahdin, was replaced here by *S. nanodes*, which is very uncommon on Katahdin (Hinds et al. 2009). This could be due to a) the different rock type (schist as opposed to Katahdin's granite); b) the somewhat higher elevation of Mt. Washington; or c) the different geographical position. Explanation a) is unlikely because *S. plicatile/tornense* is frequent on schistose rocks in the British Isles, whereas *S. nanodes* is rare, and explanation b) is also unlikely because *S. nanodes* is not considered a high-altitude specialist species whereas *S. plicatile/tornense* is. This leaves explanation c). Mt Washington is c. 175 km further south than Katahdin but also nearer the Atlantic Ocean, giving it a less northerly but more oceanic climate. It is probable that the more southern location is the more important of the two because, in Europe, *S. plicatile/tornense* is known to have a more northerly and oceanic distribution than *S. nanodes*.

An attempt was also made to find the outcrop of "lime-rich rock" (Boott Member) reported just south of Lake of the Clouds (Billings 1946, Bliss 1963). On the way *Protothelenella corrosa** was collected from a damp horizontal crevice in a schistose rock face beside the Crawford Trail about 1 km east of Lake of the Clouds and an extensive colony of *Opegrapha gyrocarpa** was noted on a damp, shaded rock face nearer Lake of the Clouds. Unfortunately, by the time we reached Lake of the Clouds there was only time to make a very cursory inspection of the area surrounding the AMC Hut where *Acarospora sinopica, Baeomyces placophyllus* and *Thamnolia vermicularis* s. lat. were recorded.

On the second day a seep at the low point of the ridge between Mt Washington and Mt. Clay was investigated. This proved to be a rich site where two species new to North America and one new to the U.S.A. were discovered. *Claurouxia chalybeioides** (first NA report) was growing directly on damp rock, along with much '*Toninia' squalescens** (third NA locality after Mt. Marcy and Katahdin; Coppins & Fryday 2006), and smaller amounts of *Frutidella caesioatra** (new to U.S.A), *Helocarpon crassipes**, *Lecidella wulfenii* and *Porina norrlinii** (first NA report) growing over bryophytes. Also visited on the second day were Ball Crag (Nelson Crag Trail), where small pebbles were found to support *Carbonea vorticosa** and *Fuscidea praeruptorum*, and the head of Tuckerman Ravine, where a scree slope on the south side was investigated. This had much the same general lichen biota as that found on the first day, but additional species of interest were *'Lecidea' commaculans** (second NA record), a *Lecidea* sp.* with cephalodia and *Helocarpon crassipes* growing directly on rock.

CONCLUSION

In two days of field work, with little preparation, three species new to North America and one new to the U.S.A. were discovered. On returning to Michigan State University I searched the herbarium for collections from the alpine zone of Mt Washington and discovered a collection of *Catillaria contristans* (wrongly identified as *Biatora hypnophila*) made by an unknown collector in 1880 (possibly Tuckerman) and labeled just "Mt. Washington". This species was recently reported as new to North America from Katahdin (Fryday 2006).

The list of species presented here (Appendix I) in no way represents the complete list of species reported from Mt. Washington because only a very cursory attempt has been made to trace previous reports either in the literature or from herbarium specimens. There is undoubtedly much more to be found in the alpine zone of Mt Washington and the other peaks of the Presidential range, and there is little doubt that more focused field work would reveal much of interest. There are also several large collections from the Presidentials in herbaria—primarily the collections of Tuckerman in the Farlow Herbarium at Harvard (FH), but also more recent collections in New York (NY) and Minnesota (MIN)—and a thorough investigation of these would probably also revel much of interest. A thorough literature search would also reveal many additional records, but these would need to be checked against the original collections to verify that they were correctly identified.

NOTES ON SPECIES RECORDED

Carbonea vorticosa (Flörke) Hertel

This species usually has a brown hypothecium and narrow spores. However, collections from loose pebbles near Ball Crag had a dark blue hypothecium and one collection also had broader spores.

***Cladonia luteoalba* A. Wilson & Wheldon**

This is a distinctive species because of the bright yellow, arachnoid lower surface of the basal squamules. It was not included by Hinds & Hinds (2007) and is indicated by Brodo et al. (2001) and Goward (1999) as being a strictly western species in North America. Unfortunately, this was not realized at the time and a voucher was not collected. It was seen once growing on soil among boulder to the west of the summit of Mt. Washington

***Claurouxia chalybeioides* (Nyl.) D. Hawksw.**

New to North America. This species is characterized by its blue-gray areolate thallus and apothecia with a prominent proper margin. Microscopically it is distinguished by its carbonaceous exciple and hypothecium, simple moniliform paraphyses, ascus type (elongate-clavate, strongly thickened at the apex, with a densely I+ blue color subtending a conspicuous I– apical cushion) and small, simple ascospores, 4–9 × 3–4 μm (Gilbert & Hawksworth 2009).

In Europe this is an uncommon species of vertical, damp, siliceous rock faces, and this was the habitat in which it was seen on Mt. Washington.

***Frutidella caesioatra* (Schaer.) Kalb**

This is the first report of this species from the United States. In North America it has previously been reported only from Greenland, the Hudson Bay area (Thomson 1997) and Newfoundland (J. Lendemer pers. comm.). It is a bryicolous species characterized by a granular, KC+ orange, UV+ blue-white thallus with sphaerophorin and thiophanic acid, and adnate apothecia with a bluish-gray pruina (Gilbert 2009).

***Helocarpon crassipes* Th. Fr.**

A bryicolous species with a scattered circum-arctic distribution. In the eastern United States it has previously been reported from only Mt. Marcy and Katahdin. It was also collected growing directly on rocks from above Tuckerman Ravine.

***Lecanora chlorophaeodes* Nyl.**

This is a distinctive species of exposed, alpine, siliceous rocks. It is characterized by its thallus of dispersed to contiguous, convex, pale yellow-green areoles with a rough surface and sessile apothecia with an entire to crenulate thalline margin. It was collected by Elisabeth Lay from the boulder field west of the summit of Mt. Washington and is also known from the mountain from a pervious collection made in 1995 at the top of Tuckerman Ravine (*Lay 95-1646*).

The North American distribution of *Lecanora chlorophaeodes* is unclear. Although it appears on the current North American checklist (Esslinger 2009) it has apparently not been reported from the North American arctic (Thomson 1997) or New York state (Harris 2004). It also does not appear in any of the checklists for individual states (http://www.biologie.uni-hamburg.de/checklists/lichens/north-america/north-america_checklists_switch.htm).

***'Lecidea' commaculans* Nyl.**

An arctic-alpine saxicolous species. Second North American record, previously known only from Katahdin (Fryday 2006).

***Lecidea* sp.**

A crustose species with a thick granular thallus lacking lichen substances by TLC, and with adnate/sessile apothecia and external cephalodia on the thallus surface. Few ascospores were seen but appeared to be simple, ca 10 x 5 μm and the ascus appeared to be *Lecidea*-type. It is possibly a species of *Lecidea* s. str., although cephalodia are unknown in that genus.

***Micarea marginata* Coppins & Muhr**

An arctic-alpine saxicolous species. Second North American record, previously known only from Katahdin (Fryday 2006). Fertile collections were made from the Crawford Trail and from above Tuckerman Ravine, and a further collection from a flat piece of loose rock near the Crawford Trail had only pycnidia present; with mesoconidia on the upper surface and macroconidia underneath.

***Opegrapha gyrocarpa* Flot.**

A usually sterile sorediate crust growing on shaded, siliceous rocks. Previously known in North America only from British Columbia, Maine and Nova Scotia, but probably overlooked (Fryday 2006).

***Porina norrlinii* Vain.**

Rare on bryophytes on a damp, vertical rock face between Mt Washington and Mt Clay. This species is similar to *P. mammillosa* (Th. Fr.) Zahlbr., the only other species of this genus that occurs on bryophytes in alpine habitats, but had a thick brown, granular thallus whereas that of *P. mammillosa* is thin, smooth and gray. Apparently previously reported only from Finland (Santesson et al. 2004).

***Protothelenella corrosa* (Körb.) H. Mayrh. & Poelt**

Previously confirmed in North America only from Katahdin, Maine, Newfoundland and Pennsylvania (Lendemer et al. 2009) but probably overlooked. An earlier record from New Brunswick is from a lowland habitat and in need of confirmation. (Fryday 2006)

***Rhizocarpon anaperum* (Vain.) Vain.**

Frequent on small pebbles near the Crawford Trail and at the head of Tuckerman ravine. Only previously correctly reported in North America from Katahdin and Colorado, but probably overlooked elsewhere in the arctic (Ihlen & Fryday 2004).

***Rhizocarpon intersitum* Arnold**

This species is characterized by a thallus containing stictic acid or no substances and asci containing eight, pigmented, muriform ascospores. *Rhizocarpon grande* (Flörke ex Flotow) Arnold (gryophoric acid) and *R. eupetraeum* (Nyl.) Arnold (norstictic acid) also have pigmented, muriform ascospores but, in addition to differing in their thalline chemistry, both these species also have a thallus with an I+ mauve medulla. *Rhizocarpon intersitum* was collected by Elisabeth Lay from the boulder field west of the summit of Mt. Washington (*Lay 08-023*).

In North America, *Rhizocarpon. intersitum* has apparently previously been reported only from Colorado (Shushan and Anderson 1969) but is possibly overlooked elsewhere for *R. grande*. It has apparently not been reported from the North American arctic (Thomson 1997).

***Stereocaulon leucophaeopsis* (Nyl.) P. James & Purvis**

New to North America. Found on a small pebble near the Crawford Trail. This is a usually sterile, crustose species characterized by an areolate, sorediate, thallus containing atranorin and lobaric acid (K+ yellow, Pd–, UV+ white). It is similar to *Stereocaulon tornense* (H. Magn.) P. James & Purvis but that species contains atranorin and stictic acid (K+ yellow, Pd+ orange, UV–).

***'Toninia' squalescens* (Nyl.) Th. Fr.**

An arctic-alpine, bryicolous species. Third North American locality; previously known only from Katahdin and Mt Marcy (Coppins & Fryday 2006). Frequent over bryophytes on a damp, vertical rock face between Mt Washington and Mt Clay.

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APPENDIX I – SPECIES REPORTED FROM MT. WASHINGTON (2008)

1 = Boulder field west of summit; 2 = trail to Lake of the Clouds; 3 = Lake of the Clouds; 4= between Mt. Washington and Mt. Clay; 5 = Ball Crag; 6 = scree above Tuckerman Ravine.	**1**	**2**	**3**	**4**	**5**	**6**
Acarospora sinopica (Wahlenb.) Körb.	.	.	x	.	.	.
Arctoparmelia centrifuga (L.) Hale	x	.	.	.	.	.
Aspicilia cinerea aggr. (L.) Körb.	x	.	.	.	.	.
Baeomyces placophyllus Ach.	.	.	x	.	.	.
Baeomyces rufus (Huds.) Rebent.	x	.	.	.	.	.
Carbonea vorticosa (Flörke) Hertel	.	.	.	.	x	.
Cetraria laevigata Rass.	x	.	.	.	.	.
Cetrariella delisei (Bory ex Schaer.) Kärnefelt & A. Thell	x	.	.	.	.	.

	Cladonia coccifera s. str. (L.) Willd.	.	.	.	x	.	.
	Cladonia coccifera aggr. (L.) Willd.	x	.	.	.	.	.
	Cladonia luteoalba A. Wilson & Wheldon	x	.	.	.	.	.
**	*Claurouxia chalybeioides* (Nyl.) D. Hawksw	.	.	.	x	.	.
	Clauzadeana macula (Taylor) Coppins & Rambold	x	.	.	.	.	.
	Ephebe lanata (L.) Vain.	.	.	.	x	.	.
*	*Frutidella caesioatra* (Schaer.) Kalb	.	.	.	x	.	.
	Flavocetraria nivalis (L.) Kärnefelt & A. Thell	x	.	.	.	.	.
	Fuscidea lowensis (H. Magn.) R.A. Anderson & Hertel	x	.	.	.	.	
	Fuscidea scrupulosa (Eckfeldt) Fryday	x	.	.	.	.	.
	Fuscidea praeruptorum (Du Rietz & H. Magn.) V. Wirth & Vězda	.	.	.	.	x	.
	Helocarpon crassipes Th. Fr.	.	.	.	x	.	x
	Hypogymnia physodes (L.) Nyl.	x	.	.	.	.	.
	Ionaspis lacustris (With.) Lutzoni	.	.	.	x	.	.
	Lecanora chlorophaeodes Nyl.	x	.	.	.	.	.
	Lecanora intricata (Ach.) Ach.	x	.	.	.	x	.
	Lecanora placidensis (H. Magn.) Knoph, Leuckert & Rambold	x	.	.	.	.	.
	Lecanora polytropa (Ehrh.) Rabenh.	x	.	.	.	x	.
	'Lecidea' commaculans Nyl.	.	.	.	.	.	x
	Lecidea lapicida (Ach.) Ach.	x	.	.	.	.	x
	Lecidea tessellata Flörke	.	.	.	.	.	x
	Lecidea sp.	.	.	.	.	.	x
	Lecidella stigmatea (Ach.) Hertel & Leuckert	.	.	.	.	.	x
	Lecidella patavina (A. Massal.) Knoph & Leuckert	x	.	.	.	.	.
	Lecidella wulfenii (Ach.) Körb.	.	.	.	x	.	.
	Lecidoma demissum (Rutstr.) Gotth. Schneid. & Hertel	x	.	.	.	.	.
	Lepraria caesioalba aggr. (B. de Lesd.) J.R. Laundon	x	.	.	x	.	.
	Melanelia hepatizon (Ach.) A. Thell	x	.	.	.	.	x
	Melanelia stygia (L.) Essl.	x	.	.	.	.	.
	Micarea lignaria (Ach.) Hedl.	x	.	.	x	.	x
	Micarea marginata Coppins & Muhr	x	.	.	.	.	x
	Micarea peliocarpa (Anzi) Coppins	x	.	.	.	.	.
	Mycoblastus sanguinarius (L.) Norman	x	.	.	.	.	.
	Ochrolechia frigida (Sw.) Lynge	x	.	.	.	.	.
	Opegrapha gyrocarpa Flot.	.	x	.	.	.	.
	Ophioparma ventosa (L.) Norman	x	.	.	.	.	.
	Orphniospora moriopsis (A. Massal.) D. Hawksw.	x	.	.	.	.	.
**	*Porina norrlinii* Vain.	.	.	.	x	.	.
	Porpidia cinereoatra (Ach.) Hertel & Knoph	.	.	.	.	.	x
	Porpidia contraponenda (Arnold) Knoph & Hertel	.	.	.	.	.	x
	Porpidia flavicunda (Ach.) Gowan	x	.	.	.	.	.
	Porpidia tuberculosa (Sm.) Hertel & Knoph	x	.	.	.	.	.
	Protoparmelia badia (Hoffm.) Hafellner	x	.	.	.	.	.
	Protoparmelia cupreobadia (Nyl.) Poelt	x	.	.	.	.	.
	Protothelenella corrosa (Körb.) H. Mayrhofer & Poelt	.	x	.	.	.	.
	Rhizocarpon anaperum (Vain.) Vain.	x	.	.	.	.	x
	Rhizocarpon badioatrum (Flörke ex Spreng.) Th. Fr.	x	.	.	.	.	x
	Rhizocarpon geographicum aggr. (L.) DC.	x	.	.	.	x	x
	Rhizocarpon hochstetteri (Körb.) Vain.	x	.	.	.	.	x
	Rhizocarpon infernulum (Nyl.) Lange	x	.	.	.	.	x

	Rhizocarpon intersitum Arnold	x	.	.	.	.	.
	Rhizocarpon oederi (Weber) Körb.	x	.	.	.	.	.
	Schaereria cinereorufa (Schaer.) Th. Fr.	x	.	.	.	.	.
	Schaereria fuscocinerea (Nyl.) Clauzade & Cl. Roux	x	.	.	.	.	.
	Sphaerophorus fragilis (L.) Pers.	x	.	.	.	.	.
**	*Stereocaulon leucophaeopsis* (Nyl.) P. James & Purvis	x	.	.	.	.	.
	Stereocaulon nanodes Tuck.	x	.	.	.	.	x
	Stereocaulon pileatum Ach.	x	.	.	.	.	x
	Thamnolia vermicularis (Sw.) Schaer. s. lat.	.	.	x	.	.	x
	'*Toninia*' *squalescens*(Nyl.) Th. Fr.	.	.	.	x	.	.
	Trapeliopsis granulosa (Hoffm.) Lumbsch	x	.	.	.	.	.
	Tremolecia atrata (Ach.) Hertel	x	.	.	.	.	x
	Tuckermanopsis sepincola (Ehrh.) Hale (krumholtz)	.	.	x	.	.	.
	Umbilicaria hyperborea (Ach.) Hoffm.	x	.	.	.	.	.
	Umbilicaria proboscidea (L.) Schrad.	x	.	.	.	.	.
	Vulpicida pinastri (Scop.) J.-E. Mattsson (krumholtz)	.	.	x	.	.	.

** - new to North America; * - new to U.S.A.

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Lichenicolous fungi and lichens growing on *Stereocaulon* from the Holarctic, with a key to the known species

MIKHAIL P. ZHURBENKO[1]

ABSTRACT. – A total of 22 species of lichenicolous fungi and three lichens are reported on *Stereocaulon* species and discussed. *Lichenopeltella stereocaulorum* sp. nov., *Lichenosticta dombrovskae* sp. nov. and *Odontotrema stereocaulicola* sp. nov. are described from *Stereocaulon*. *Arthonia stereocaulina, Opegrapha stereocaulicola, Rhymbocarpus stereocaulorum* and *Sphaerellothecium stereocaulorum* are reported new to North America (except Greenland); *Endococcus nanellus* is new to Kazakhstan, Alaska and Greenland; *Arthonia stereocaulina* and *Opegrapha stereocaulicola* are new to Svalbard; *Catillaria stereocaulorum, Cercidospora stereocaulorum, Lasiosphaeriopsis stereocaulicola, Polycoccum trypethelioides* and *Taeniolella christiansenii* are new to the U.S.A.; *Catillaria stereocaulorum* and *Niesslia peltigericola* are new to the Canadian Arctic; *Lasiosphaeriopsis stereocaulicola* and *Taeniolella christiansenii* are new to British Columbia; and *Catillaria stereocaulorum* is new to Mongolia. *Anzina carneonivea, Endococcus rugulosus* s. l., *Niesslia peltigericola, Phaeosporobolus alpinus* and *Protothelenella sphinctrinoidella* are newly documented on *Stereocaulon*. Seventeen species of *Stereocaulon* are new hosts for various lichenicolous fungi. A key to the 39 species of fungi and lichens known to occur on *Stereocaulon* is provided. Study of the host relationships of lichenicolous fungi on *Stereocaulon* does not support a close relationship between the crustose and fruticose species of the genus. Terricolous arctic species of *Stereocaulon* with more solid thallus structure are more frequently colonized by fungi when compared to species with lax thalli.

INTRODUCTION

Stereocaulon Hoffm. is a widespread lichen genus comprising 137 species, most of which are fruticose macrolichens (Kirk et al. 2008). A decade ago just nine species of lichenicolous fungi were known to occur on members of the genus (Zhurbenko 2000). However, recent studies have revealed much a higher diversity of stereocaulicolous fungi (Etayo 2002, Ihlen & Wedin 2007, Zhurbenko & Triebel 2008, Zhurbenko et al. 2009). The aims of this paper are: 1) describe three new species of stereocaulicolous fungi and provide information about another two undescribed species of unclear taxonomic position; 2) present new information on ecology, geography and species composition of mycobiota growing on *Stereocaulon*; 3) provide a worldwide key for these fungi; and 4) test the relationship of crustose and fruticose species of *Stereocaulon* on the basis of their associated fungi.

MATERIALS AND METHODS

The study is based on 392 samples of lichenicolous fungi and lichens from 27 regions of the Holarctic, mostly from the Arctic (Plate 1). These finds occurred on 20 fruticose host species (*Stereocaulon alpestre, S. alpinum, S. arcticum, S. arenarium, S. botryosum, S. capitellatum, S. depressum, S. glareosum, S. grande, S. groenlandicum, S. incrustatum, S. intermedium, S. myriocarpum, S. paschale, S. rivulorum, S. saxatile, S. subcoralloides, S. symphycheilum, S. tomentosum* and *S. vesuvianum*) and one crustose host species (*S. plicatile*). Two hundred fifty-three specimens were collected by the author; the others were found in undetermined lichen gatherings from various collectors (see acknowledgements) donated to the

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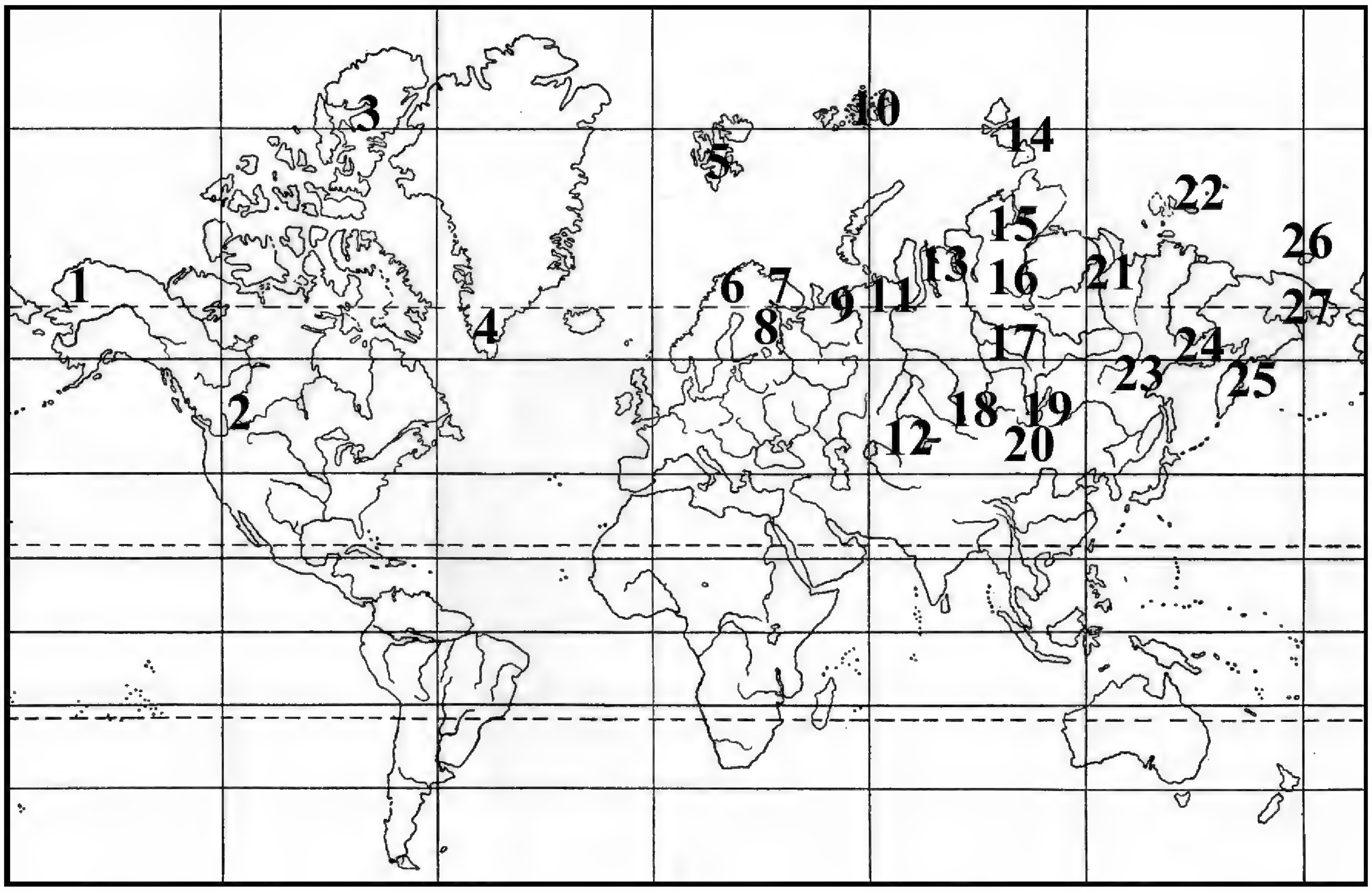

Plate 1. Geographical location of the main collecting regions: 1 – Alaska (USA), 2 – British Columbia (CANADA), 3 – Canadian Arctic Archipelago (CANADA), 4 – Greenland (DENMARK), 5 – Svalbard (NORWAY), 6 – Troms County (NORWAY), 7 – Murmansk Region (RUSSIA), 8 – Karelia (RUSSIA), 9 – Nenets Region (RUSSIA), 10 – Franz Josef Land (RUSSIA), 11 – Polar Ural (RUSSIA), 12 – KAZAKHSTAN, 13 – Gydan Pen. (RUSSIA), 14 – Severnaya Zemlya (RUSSIA), 15 – Taimyr Pen. (RUSSIA), 16 – Putorana Plateau (RUSSIA), 17 – Evenkiya (RUSSIA), 18 – Tyva, Sayan and Altai Mts. (RUSSIA), 19 – Baikal Siberia (RUSSIA), 20 – MONGOLIA, 21 – mainland Yakutiya (RUSSIA), 22 – New Siberian Islands (RUSSIA), 23 – Khabarovsk Territory (RUSSIA), 24 – Magadan Region (RUSSIA), 25 – Kamchatka Pen. (RUSSIA), 26 – Wrangel' Island (RUSSIA), 27 – Chukotka (RUSSIA).

author. Crustose *Stereocaulon* species were not specifically searched for the associated fungi. Endophytic fungi of *Stereocaulon* species (see Petrini et al. 1990) were omitted from this study. Examined materials are mostly housed in the LE-Fungi herbarium; some specimens are deposited in H and M.

The material was studied and photographed using Zeiss Stemi 2000-CS microscopes and an Axio Imager A1 equipped with Nomarski differential interference contrast optics. Microscopical examination was done in water, 10 % KOH (K), Lugol's iodine, directly (I) or after a KOH pre-treatment (K/I), HNO_3, Brilliant Cresyl blue (BCr) or phloxin (1% in water) solutions. The length, breadth and length/breadth ratio (l/b) of asci, ascospores and conidia are mostly given as: (min–){$\bar{x}$-SD}–{$\bar{x}$+SD}(–max), where min and max are the extreme values, $\bar{x}$ the arithmetic mean and SD the corresponding standard deviation. Microscopical measurements were made in water, unless otherwise indicated. Sizes of asci were rounded to the nearest 1 µm, those of ascospores and conidia to the nearest 0.5 µm. Terms for simple plane shapes and colors mostly follow Stearn (1992: 539) and Petersen (1996), respectively. Classification and nomenclature of taxa above the generic level follow Lumbsch & Huhndorf (2007). Authors of host taxa are omitted throughout this paper.

THE SPECIES

Abbreviations: Is. – Island, Mt(s). – Mountain(s), Pen. – Peninsula. Lichens are designated by "*".

1. *_Anzina carneonivea_ (Anzi) Scheid.

Notes. – This lichen usually grows on mosses, bark or lignum (Santesson et al., 2004). It has also been reported on lichens such as *Cladonia* and *Peltigera* (e.g. Hafellner 2000), but not previously on *Stereocaulon*.

Specimen Examined. – **RUSSIA. Karelia:** Kandalakshskii Gulf of White Sea, Keret’ Is., 66°19’N, 33°42’E, alt. 40 m, rocks, on *Stereocaulon saxatile* (healthy-looking phyllocladia), 9.vii.1998, *D. Himelbran*t (LE 210402:b).

2. *Arthonia stereocaulina* (Ohlert) R. Sant.

Notes. – Ascomata apothecial, usually superficial, convex, subglobose or irregular in shape, sometimes applanate from above or mostly immersed and only slightly elevating above the host thallus surface, (0.05–)0.1–0.25(–0.5) mm diam., smooth, black, shiny, arising singly or more often aggregated to confluent. Epithecium olive-brown. Hymenium I+, K/I+ purple to brown red. Hypothecium brown. Asci (25–)26–35.5(–38) × (10–)13–21.5(–25) µm (n = 10). Ascospores hyaline, soleiform to narrowly ovate or lanceolate, 1-septate, usually constricted at the septum, with unequal cells (usually the upper one boader), (10.5–)11.5–14(–17) × (4–)4.5–6(–7.5) µm, l/b = (1.7–)2.1–2.9(–3.9) (n = 141).

Found on phyllocladia, rarely on stems of *Stereocaulon alpinum, S. arcticum, S. botryosum, S. capitellatum, S. depressum, S. glareosum, S. groenlandicum, S. intermedium, S. myriocarpum, S. paschale, S. rivulorum, S. saxatile* and *S. tomentosum*. Mostly commensalistic, rarely causes slight bleaching of host tissues. *Stereocaulon arcticum, S. intermedium, S. myriocarpum, S. paschale, S. saxatile* and *S. tomentosum* are new host species. New to North America (except Greenland), Svalbard, Nenets Region, Sayan Mts., Baikal Siberia and mainland Yakutiya.

Specimens Examined. – **U.S.A. Alaska:** Great Kobuk Sand Dunes, 67°06’N, 159°01’W, alt. 50 m, lichen heath with sparse *Picea*, on *S. glareosum*, 11.viii.2000, *M. Zhurbenko 00464* (LE 233527); Wrangell-Saint Elias Park and Preserve, Mt. George, 60°59’N, 141°28’W, alt. 1783 m, mountain tundra, on *S. alpinum*, 17.vii.2004, *T. Jorgenson* (LE 233427:a). **CANADA. Canadian Arctic Archipelago:** Ellef Ringnes Is., Isachsen Bay, 78°47’N, 103°32’W, alt. 70 m, stony arctic desert, on *S. groenlandicum*, 25.vii.2005, *N. Matveeva* (LE 233750); on *S. botryosum*, 20.vii.2005, *N. Matveeva* (LE 233592). **SVALBARD.** Nordenskiöld Land, 3 km N of Barentsburg, 78°05’N, 14°13’E, alt. 100 m, wet scree, on *S. rivulorum*, 14.vii.2003, *M. Zhurbenko 03268* (LE 233759); W coast of Grønfjorden, Aldegondabreen Glacier, 78°00’N, 14°12’E, alt. 100 m, fellfield in tundra, on *S. botryosum* (phyllocladia, rarely stems), 16.vii.2003, *M. Zhurbenko 03264* (LE 233457). **RUSSIA. Murmansk Region:** Khibiny Mts., Akademicheskoe Lake, 67°43 N, 33°49 W, alt. 700 m, fellfield in tundra, on *S. saxatile*, 20.viii.2007, *M. Zhurbenko 0748* (LE 210438). – **Nenets Region:** Bol’shezemel’skaya Tundra, Ortin River, Vorgashor Stream, 67°50’N, 54°03’E, dwarf shrub tundra on sand, on *S. arcticum*, 29.vi.1999, *O. Lavrinenko* (LE 233437); on *S. rivulorum*, 29.vi.1999, *O. Lavrinenko* (LE 233484:b); Khar’yaga oilfield, 67°11’N, 56°30’E, alt. 60 m, tundra, on *S. paschale*, 24.vii.2007, *M. Zhurbenko 0718* (LE 210330). **Severnaya Zemlya:** Bol’shevik Is., Ostantsovaya River, 79°13’N, 102°02’E, alt. 40 m, rocks, on *S. glareosum*, 12.vii. 1996, *M. Zhurbenko 96947:a* (LE 233407:a); Mushketova Glacier, 79°11’N, 102°09’E, alt. 200 m, stony arctic desert, on *S. botryosum*, 11.vii.1996, *M. Zhurbenko 96112:c* (LE 233572:c). **Taimyr Pen.:** Eniseyskii Gulf coast, Ragozinka River mouth, 72°48’N, 80°53’E, alt. 10 m, dwarf shrub tundra, on *S. rivulorum*, 11.vii.1990, *M. Zhurbenko 90373* (LE 207709); same coast, Osipovka River, 72°42’N, 80°51’E, alt. 40 m, boulder field in tundra, on *S. botryosum*, 18.vii. 1990, *M. Zhurbenko 90831:a* (LE 233709:a), *M. Zhurbenko 90828* (LE 233810); on *S. groenlandicum*, 18.vii.1990, *M. Zhurbenko 90839:d* (LE 233729:d); lower Pravaya Uboinaya River, "217" Mt., 73°26’N, 82°43’E, alt. 150 m, stony tundra, on *S. groenlandicum*, 5.viii.1990, *M. Zhurbenko 90841* (LE 233830); on *S. botryosum*, 5.viii.1990, *M. Zhurbenko 90832:b* (LE 233930:b); Byrranga Mts., N of Levinson-Lessinga Lake, 74°31’N, 98°36’E, alt. 330 m, rocks in tundra, on *S. groenlandicum*, 27.vii.1994, *M. Zhurbenko 94504* (LE 233547); S of Levinson-Lessinga Lake, 74°24’N, 98°46’E, alt. 120 m, rocks in tundra, on *S. depressum*, 28.viii.1995, *M. Zhurbenko 9523* (LE 233447); middle Krasnaya River, 74°35’N, 98°28’E, alt. 110 m, rocks in tundra, on *S. botryosum*, 12.viii.1994, *M. Zhurbenko 94503* (LE 233517); middle Bol’shaya Bootankaga River, 74°30’N, 97°45’E, alt. 370 m, rocks in tundra, on *S. capitellatum*, 16.viii.1995, *M. Zhurbenko 9519* (LE 233537); on *S. depressum*, 16.viii.1995, *M. Zhurbenko 95428* (LE 233477). **Putorana Plateau:** Nyakshinda River, ca. 67°00’N, 93°15’E, alt. 400 m, *Larix* taiga, on *S. tomentosum*, 17.vii.1970, *V. Kuvaev* (LE 233567). **Eastern Sayan Mts.:** Kryzhina Range, headwaters of Belyi Kitat River, 53°59’N, 95°28’E, alt. 1500 m, above boulder in sparse *Pinus sibirica-Abies sibirica* forest, on *S. myriocarpum*, 15.vii.2009, *M. Zhurbenko 0931* (LE 260131); 5 km N of Mondy, 51°43’N, 101°00’E, alt. 2150 m, mountain tundra, on *S. glareosum*, 14.vi.2005, *M. Zhurbenko 05222:b* (LE 233779:b). **Baikal Siberia:** Khamar-Daban Range, Khamarskaya griva, on *S. paschale*, 5.viii.1927, *V. Smirnov* (LE 233607); same range, Baikal’skii Reserve, forest, on *S. saxatile*, 1996, *I. Urbanavichene* (LE 206940); Dzherginskii Reserve, headwaters of Dzhirga River, ca. 55°00’N, 111°45’E, alt. 1500 m, on *S. paschale*, 18.vii.2002, *T. Kharpukhaeva* (LE 233740). **Mainland Yakutiya:** Lena River delta, Stolb Is., 72°24'N, 126°40'E, alt. 50 m, tundra, on *S. alpinum*, 12.viii.1998, *M. Zhurbenko 9812* (LE 233497); Laptevykh Sea coast, 3 km SW of Tiksi, 71°40'N, 128°40'E, alt. 50 m, scree tundra, on *S. rivulorum*, 17.vii.1998, *M. Zhurbenko 9844* (H, LE 233597); on *S. capitellatum*, 17.vii.1998, *M. Zhurbenko 9837* (LE 233467); on *S. groenlandicum*, 17.vii.1998, *M. Zhurbenko 9846:b* (LE 233541:b); 3 km NW of Tiksi, 71°39'N, 128°45'E, alt. 70 m, scree tundra, on *S. depressum*, 24.viii.1998, *M. Zhurbenko 9822* (LE 233577); *M. Zhurbenko 9848* (LE 233507); on *S. glareosum*, 24.viii.1998, *M. Zhurbenko 9821* (M); middle Indigirka River, 8 km SW of Ust-Nera, 64°31'N, 143°08'E, alt. 1000 m, stone field in subalpine belt, on *S. intermedium*, 23.vii.1992, *M. Zhurbenko 92513:a* (LE 207724:a). **Wrangel' Is.:** Krasnyi Flag River, ca. 71°30'N, 178°55'W, on *S. alpinum*, 20.viii.1938, *B. Gorodkov* (LE 233557, LE 233487). **Chukotka:** Nauneson Mt., 67°15'N, 178°40'W, tundra, on *S. alpinum*, 14.viii.1970, *A. Katenin* (LE 233587).

3. *Catillaria stereocaulorum* (Th. Fr.) H. Olivier

(syn. *Scutula stereocaulorum* (Anzi) Körb.)

Notes. – Ascomata apothecial, 0.1–0.8 mm diam., sessile, discoid and flat to subglobose, more or less constricted at the base, with prominent margin or emarginate, at first brown then black, glossy, sometimes with golden-yellow, K+ red orange surface depositions. Epithecium reddish brown, 5–10 µm tall, sometimes with orange or red hue; paraphyses with dark reddish brown apical caps 4–8 µm diam. Hymenium 50–80 µm tall, hyaline to pale yellowish brown; walls of asci I+, K/I+ blue-green, interascal gel I–, K/I–. Hypothecium 100–250 µm tall, hyaline to pale yellowish brown, I+, K/I+ violet, with geenish yellow, K+ red orange, inclusions. Marginal exciple brown, I+, K/I+ violet. Ascospores hyaline, elliptic to narrowly elliptic or narrowly oblong, (0–)1-septate, not constricted at the septum, cells more or less equal, (10.5–)13.5–17.5(–19) × (3.5–)4–5.5(–6.5) µm, l/b = (2.1–)2.6–4.2(–4.9) (n = 41), wall smooth, without halo. Conidiomata pycnidial, brown, cupuliform, 50–130 µm diam., immersed. Conidia aseptate, hyaline, falcate to bacilliform, (8–)10–12.5(–13.5) × 1–1.5 µm, l/b = (5.3–)6.6–10.4(–12) (n = 33).

Found on phyllocladia, rarely stems or soralia of *Stereocaulon alpestre, S. alpinum, S. botryosum, S. depressum, S. groenlandicum, S. grande, S. intermedium, S. paschale, S. rivulorum, S. saxatile, S. subcoralloides* and *S. tomentosum*. Infected host phyllocladia sometimes become swollen and/or dark, otherwise commensalistic. This is the most common and conspicuous fungus on *Stereocaulon* in the Arctic. *Stereocaulon grande* and *S. intermedium* are new host species. New to the U.S.A., Mongolia, Canadian Arctic Archipelago, Nenets Region, Sayan Mts., Baikal Siberia and Wrangel' Is.

Specimens Examined. – **U.S.A. Alaska:** Seward Pen., 7 km NE of Nome, Newton Peak, 64°33'N, 165°22'W, alt. 240 m, stony tundra, on *S. rivulorum*, 5.ix.2001, *M. Zhurbenko 0170:a* (LE 233561:a); on *S. subcoralloides*, 4.ix. 2001, *M. Zhurbenko 0169* (LE 233481); Great Kobuk Sand Dunes, ca. 67°05'N, 159°00'W, alt. 50 m, lichen heath with sparse *Picea*, on *S. rivulorum*, 13.viii.2000, *M. Zhurbenko 00184* (LE 233451); on *S. alpestre*, 2.viii.2000, *M. Zhurbenko 0050* (LE 233441); 4.viii.2000, *M. Zhurbenko 0042* (LE 233431); 11.viii.2000, *M. Zhurbenko 00193* (LE 233411); 30.vii.2000, *M. Zhurbenko 00100* (LE 233421); mixed forest, on *S. grande*, 9.viii.2000, *M. Zhurbenko 00107* (LE 233401); Wrangell-Saint Elias Park and Preserve, Chititu Ridge, 61°15'N, 142°33'W, alt. 1364 m, shrub mountain tundra, on *S. paschale*, 16.vii.2004, *J. Roth* (LE 233471); same park, Yakutat, ca. 59°48'N, 140°00'W, on *S. alpestre*, 5.vii.2004, *G. Frost* (LE 233461). **CANADA. Canadian Arctic Archipelago:** Ellef Ringnes Is., Isachsen Bay, 78°48'N, 103°36'W, alt. 50 m, arctic desert, *S. rivulorum*, 25.vii.2005, *N. Matveeva* (LE 233571). **British Columbia:** Wells Gray Provincial Park, Raft Mt., 51°44'N, 119°50'W, alt. 2100 m, stony mountain tundra, on *S. rivulorum*, 13.vii. 2002, *M. Zhurbenko 02188* (LE 233829); on *S. alpinum*, 3.viii.2002, *M. Zhurbenko 02322* (LE 233819); Spahats Creek Falls, 51°44'N, 120°01'W, alt. 550 m, forest, on *S. tomentosum*, 8.vii.2002, *M. Zhurbenko 02256* (LE 233582). **SVALBARD:** Dickson Land, 5 km S of Pyramiden, Garmaksla Mt., 78°37'N, 16º20'E, alt. 100 m, stony tundra, on *S. rivulorum*, 23.vii.2003, *M. Zhurbenko 03265:b* (LE 233749:b). **RUSSIA. Franz Josef Land:** Alexandry Land, ca. 80°45'N, 47°25 E, arctic desert, on *S. rivulorum*, 29.vi.1959, *V. Alexandrova* (LE 233553). **Murmansk Region:** Khibiny Mts., Akademicheskoe Lake, 67°43'N, 33°49'W, alt. 700 m, stony mountain tundra, on *S. saxatile*, 20.viii. 2007, *M. Zhurbenko 0757* (LE 210455); same mountains, 5 km SE of Umbozerskii Pass, Kaskasnyunjok Stream, 67°46'N, 33°49'W, stony mountain tundra, on *S. alpinum*, 18.viii.2007, *M. Zhurbenko 0763* (LE 210347). **Nenets Region:** Malozemel'skaya Tundra, Seduiyakha River, 68°23'N, 53°15'E, dwarf shrub tundra, on *S. rivulorum*, 3.viii. 1998, *O. Lavrinenko* (LE 233651); Bol'shezemel'skaya Tundra, Ortin River, Vorgashor Stream, 67°50'N, 54°03'E, dwarf shrub tundra, on *S. rivulorum*, 29.vi.1999, *O. Lavrinenko* (LE 233675); same Tundra, Pechora River delta, 25 km S of Bolvanskii Nos Cape, ca. 68°15'N, 54°27'E, dwarf shrub tundra, on *S. rivulorum*, 28.vi.1997, *O. Lavrinenko* (LE 207695); 24.vii.1999, *O. Lavrinenko* (LE 233661); same Tundra, Khar'yaga oilfield, 67º08'N, 56º47'E, alt. 70 m, *Betula nana* tundra, on *S. paschale*, 22.vii.2007, *M. Zhurbenko 0717* (LE 210387). **Polar Ural:** Rai-Iz Mt., 66°46'N, 65°13'E, alt. 320 m, stony tundra, on *S. depressum*, 23.viii.2001, *S. Kholod* (LE 233710:b). **Severnaya Zemlya** [all in arctic desert]**:** Bol'shevik Is., middle Studenaya River, 78°37'N, 101°05'E, alt. 130 m, on *S. rivulorum*, 15.viii.1998, *N. Matveeva* (LE 233523); middle Golysheva River, 78°26'N, 104°28'E, alt. 170 m, on *S. rivulorum*, 2000, *N. Matveeva*

(LE 232170); Cape Antsevaa, 78°12'N, 103°17'E, alt. 60 m, on *S. rivulorum*, 27.viii.1998, *N. Matveeva* (LE 233543). **Taimyr Pen.:** Dikson Is., 73°30'N, 80°20'E, alt. 30 m, tundra, on *S. alpinum*, 7.vii.1990, *M. Zhurbenko 90367* (LE 207698); Eniseyskii Gulf coast, Ragozinka River mouth, 72°48'N, 80°53'E, alt. 30 m, stony *Dryas* tundra, on *S. depressum*, 12.vii.1990, *M. Zhurbenko 90369:b* (LE 207694:b); on *S. alpinum*, 5.vii.1990, *M. Zhurbenko* 90374 (LE 207708); same coast, Osipovka River, 72°42'N, 80°51'E, alt. 50 m, boulders in tundra, on *S. groenlandicum*, 18.vii. 1990, *M. Zhurbenko 90839:b* (LE 233729:b); Byrranga Mts., N of Levinson-Lessinga Lake, 74°31'N, 98°36'E, alt. 300–500 m, stony tundra, on *S. rivulorum*, 20.vii.1995, *M. Zhurbenko 9532* (LE 233473); 24.vii.1995, *M. Zhurbenko 95234* (LE 233413); 10.viii.1995, *M. Zhurbenko 9524* (LE 233472) [with anamorph]; 20.viii.1995, *M. Zhurbenko 9525* (LE 233433); on *S. botryosum*, 20.vii.1995, *M. Zhurbenko 9537* (LE 233403); on *S. groenlandicum*, 10.viii.1995, *M. Zhurbenko 95237* (LE 233423) [with anamorph]; alt. 250 m, rocks in tundra, on *S. groenlandicum*, 10.viii.1995, *M. Zhurbenko 9529* (LE 233493); alt. 180 m, scree tundra, on *S. groenlandicum*, 26.viii.1995, *M. Zhurbenko 95235* (LE 233483); alt. 130 m, rocks in tundra, on *S. depressum*, *M. Zhurbenko 9521* (LE 233443); alt. 300 m, boulder field in tundra, on *S. depressum*, 30.viii.1995, *M. Zhurbenko 959* (LE 233632) [with anamorph]; middle Bol'shaya Bootankaga River near Krasnoe Lake, 74°30'N, 97°45'E, alt. 350 m, scree tundra, on *S. rivulorum*, 18.viii.1995, *M. Zhurbenko 9530* (LE 233533); on *S. groenlandicum*, 18.viii.1995, *M. Zhurbenko 95434* (LE 233671); same river, Kiryaka Plateau, 74°20'N, 98°05'E, alt. 430 m, stony tundra, on *S. depressum*, 22.vii.1991, *V. Kuvaev* (LE 207736); Khatanga, 71°58'N, 102°27'E, sparse *Larix* forest, on *S. alpinum*, 4.ix.1995, *M. Zhurbenko 95241* (M), *M. Zhurbenko* 9513:a (LE 233462:a) [with anamorph]. **Putorana Plateau:** Kapchuk Lake, 69°28'N, 91°02'E., on *S. subcoralloides*, 18.viii.1983, *M. Zhurbenko 83206* (LE 233573). **Eastern Sayan Mts.:** Kryzhina Range, headwaters of Belyi Kitat River, 54°01'N, 95°27'E, alt. 1800 m, mountain tundra, on *S. intermedium*, 2.vii.2009, *M. Zhurbenko 0929* (LE 260162). **Baikal Siberia:** Dzherginskii Reserve, Moil Mt., 55°05'N, 111°33'E, alt. 1800 m, mountain tundra, on *S. alpinum*, 12.vii.2002, *T. Kharpukhaeva* (LE 233611). **Mainland Yakutiya:** Lena River delta, 3 km E of Krest-Tumsa Cape, 72°22'N, 126°42'E, alt. 50 m, *Dryas* tundra, on *S. alpinum*, 4.viii.1998, *M. Zhurbenko 9836* (LE 233621); same delta, Samoilovskii (D'ieleekh Aryyta) Is., 72°22'N, 126°29'E, alt. 10 m, lichen-moss tundra, on *S. alpinum*, 9.viii.1998, *M. Zhurbenko 9820* (H, LE 233503); 15.viii.1998, *M. Zhurbenko 987* (LE 233631); same delta, Bol'shaya Tumatskaya Channel, Amerika-Khaya hill, 72°35'N, 126°18'E, alt. 50 m, tundra, on *S. alpinum*, 30.vii.1998, *M. Zhurbenko 9816* (LE 233591); lower Lena River, Tit-Ary Is., 71°58'N, 126°18'E, alt. 30 m, *Larix* forest-tundra, on *S. alpinum*, 20.viii. 1998, *M. Zhurbenko 9827* (LE 233691) [with anamorph]; same river, Kharaulakh Range, Yuryung-Kysam Urochishche opposite Tit-Ary Is., 71°59'N, 126°19'E, alt. 150 m, tundra, on *S. alpinum*, 19.viii.1998, *M. Zhurbenko 9815* (LE 233601); Laptevykh Sea coast, 3 km NW of Tiksi, 71°39'N, 128°45'E, alt. 70 m, dwarf shrub tundra, on *S. alpinum*, 24.viii.1998, *M. Zhurbenko 9818* (LE 233463); on *S. rivulorum*, 24.viii.1998, *M. Zhurbenko 9819* (LE 233641); 1 km S of Tiksi, 71°37'N, 128°54'E, alt. 70 m, dwarf shrub tundra, on *S. rivulorum*, 18.vii.1998, *M. Zhurbenko 9834* (LE 233681). **New Siberian Islands:** Bennetta Is. [all in stony arctic desert], Zeberga Glacier, ca. 76°40'N, 149°00'E, alt. 180 m, on *S. groenlandicum*, 18.vii.1989, *M. Zhurbenko 8974* (LE 207689); on *S. rivulorum*, 13.vii.1989, *M. Zhurbenko 8971* (LE 207676); on *S. depressum*, 13.vii.1989, *M. Zhurbenko 8989* (LE 233513); alt. 30 m, Andreevskaya River, on *S. rivulorum*, 16.viii.1989, *M. Zhurbenko 8978* (LE 207681); alt. 70 m, on *S. groenlandicum*, 4.viii.1989, *M. Zhurbenko 8982* (LE 207679); Malyi Glacier, alt. 120 m, on *S. depressum*, 19.vii.1989, *M. Zhurbenko 8979* (LE 207687). **Wrangel' Is.:** Komsomola Lagoon, ca. 71°20'N, 179°23'E, alt. 10 m, moss-sedge tundra, on *S. alpinum*, 15.viii.1991, *V. Shtrik* (LE 233581). **Chukotka:** Iul'tin, dwarf tundra, on *S. rivulorum*, 21.vii.1967, *Anonymous* (LE 233563). **MONGOLIA. Khangai Upland:** Khan-Khukhei Range, Dulga-Ula Mt., 49°27'N, 94°42'E, alt. 2928 m, mountain meadow, on terricolous *Stereocaulon* sp., 9.vii.1976, *L. Biazrov* (LE 233453).

4. *Cercidospora stereocaulorum* (Arnold) Hafellner

Notes. – Ascomata perithecial, subglobose, often applanate and sometimes depressed from above, 0.1–0.2(–0.3) mm diam., sometimes with distinct ostiole 10–40 µm diam., smooth, black, shiny, immersed to superficial, arising singly or more often aggregated into groups, sometimes confluent. Peridium blue-green, sometimes with olive hue, intensively coloured above, pale to colourless below. Asci subcylindrical, with short foot, (40–)54–80(–90) × (9–)10–14(–15) µm (n = 36), (2–)4(–8)-spored. Ascospores narrowly elliptic and usually with attenuated lower part, straight to slightly curved, (1–)3(–6)-transseptate, sometimes constricted at septa, sometimes guttulate, (13–)18.5–25.5(–30) × (4–)5–7(–8) µm, l/b = (2.2–)2.9–4.5(–6.4) (n = 186), smooth-walled, without distinct perispore, mostly overlapping uniseriate in the ascus.

Cercidospora sterocaulorum is very similar to *C. punctillata* (Nyl.) R. Sant. and *C. decolorella* (Nyl.) O.E. Erikss. & J.Z. Yue. *Cercidospora punctillata* grows on a wide range of lichen taxa, mostly on *Solorina crocea* and *Peltigera* spp. and *C. decolorella*, according to Santesson et al. (2004), grows on terricolous mosses. These species are distinguished by septation of the ascospores and the number of spores per ascus (Hafellner 1987). However, my observations indicate that both features are very variable in the species. The distinction between *C. sterocaulorum* and *C. alpina* Ihlen & Wedin, the other species of the genus described from *Stereocaulon* (Ihlen & Wedin 2007), also merits further study (see the key below).

Found on phyllocladia, stems, occasionally cephalodia and old apothecia of *Stereocaulon botryosum, S. depressum, S. glareosum, S. groenlandicum, S. intermedium, S. paschale, S. rivulorum, S. saxatile, S. subcoralloides, S. symphycheilum* and *S. vesuvianum.* Sometimes induces gall-like swellings up to 1.5 mm diam., infected host tissues sometimes become pinkish or slightly bleached, otherwise commensalistic. *Stereocaulon intermedium* and *S. symphycheilum* are new host species. New to the U.S.A., Nenets Region, Sayan Mts., Baikal Siberia, mainland Yakutiya and New Siberian Islands.

SPECIMENS EXAMINED. – **U.S.A. ALASKA:** Prudhoe Bay, 70°20'N, 148°42'W, on *S. vesuvianum*, 1989, *C. Parker* (LE 233404). **CANADA. CANADIAN ARCTIC ARCHIPELAGO:** Axel Heiberg Is., Bunde Fjord, 80°30'N, 94°35'W, scree *Dryas* vegetation, on *S. rivulorum*, 1.viii.1999, *N. Matveeva* (LE 233464); Ellesmere Is., Eureka, 80°06'N, 85°38'W, alt. 170 m, scree *Dryas* vegetation, on *S. groenlandicum*, 31.vii.1999, *N. Matveeva* (LE 233594, LE 233554); 80°03'N, 86°25'W, alt. 600 m, altitudinal variant of arctic desert, on *S. rivulorum*, 30.viii.1999, *N. Matveeva* (LE 233444); Ellef Ringnes Is., Isachsen Bay, 78°48'N, 103°36'W, alt. 70 m, arctic desert, on *S. rivulorum*, 26.vii.2005, *D. Walker* (LE 233655); on *S. botryosum*, 25.vii.2005, *N. Matveeva* (LE 233990); 20.vii.2005, *N. Matveeva* (LE 233760). **BRITISH COLUMBIA:** Wells Gray Provincial Park, Raft Mt., 51°44'N, 119°50'W, alt. 2100 m, mountain tundra, on *S. rivulorum*, 13.vii.2002, *M. Zhurbenko 02184* (LE 233999); Selkirk Mts., Columbia River Valley, N of Revelstoke, Downie Creek mouth, alt. 650 m, open boulder field, on *S. intermedium*, 20.vii.2002, *M. Zhurbenko 02138:b* (LE 233839:b). **GREENLAND.** Mellem Land, 1 km NE of Narsarsuaq, Signalhojen Mt., 61°10'N, 45°24'W, alt. 100 m, shrub tundra, on *S. rivulorum*, 25.vii.2005, *M. Zhurbenko 05290* (LE 233809). **SVALBARD.** North-East Land, Murchison Fjorde, Wargentin-fjellet, 80°03'N, 18°48'E, alt. 200 m, on *S. groenlandicum*, 17.viii.2007, *N. Matveeva* (LE 210495); Dickson Land, 5 km S of Pyramiden, Garmaksla Mt., 78°37'N, 16°20'E, alt. 100 m, moss-lichen tundra, on *S. rivulorum*, 23.vii. 2003, *M. Zhurbenko 03265:a* (LE 233749:a) **RUSSIA. MURMANSK REGION:** Khibiny Mts., Akademicheskoe Lake, 67°43'N, 33°49'W, alt. 700 m, stony mountain tundra, on *S. saxatile*, 20.viii.2007, *M. Zhurbenko 0751* (LE 210380). **NENETS REGION:** Bol'shezemel'skaya Tundra, Ortin River, Vorgashor Stream, 67°50'N, 54°03'E, dwarf shrub tundra, on *S. rivulorum*, 29.vi.1999, *O. Lavrinenko* (LE 233504). **POLAR URAL:** Sob' River at 129 km of the railway Vorkuta-Labytnangi, 66°59'N, 65°45'E, alt. 350 m, stony dwarf shrub tundra, on *S. subcoralloides*, 17.vii.1986, *M. Zhurbenko 8698* (LE 233583). **TYVA:** Todzhinskaya Depression, W of Kadysh Lake, 52°36'N, 97°02'E, alt. 1100 m, on *S. paschale* over mossy stone, 30.viii.1999, *T. Otnyukova* (LE 260203:c). **SEVERNAYA ZEMLYA** [all in arctic desert]**:** Bol'shevik Is., Mys Baranova polar station, 79°16'N, 101°40'E, alt. 10 m, on *S. rivulorum*, 13.vii.1996, *M. Zhurbenko 96109* (LE 233542), *M. Zhurbenko* 96111 (M); Mushketova Glacier, 79°11'N, 102°09'E, alt. 200 m, on *S. botryosum*, 11.vii.1996, *M. Zhurbenko 96112:b* (LE 233572:b); middle Golysheva River, 78°26'N, 104°28'E, alt. 170 m, on *S. groenlandicum*, 5.viii.2000, *N. Matveeva* (LE 232119); on *S. rivulorum*, 7.viii.2000, *N. Matveeva* (LE 232200); Cape Antseva, 78°13'N, 103°15'E, alt. 40 m, on *S. botryosum*, 21.viii.1998, *N. Matveeva* (LE 233613); 16.vii.2000, *N. Matveeva* (LE 232167:b); on *S. groenlandicum*, 19.vii.2000, *N. Matveeva* (LE 232159). **TAIMYR PEN.:** Eniseyskii Gulf coast, Osipovka River, 72°42'N, 80°51'E, alt. 50 m, boulders in dwarf shrub tundra, on *S. groenlandicum*, 18.vii.1990, *M. Zhurbenko 90839:c* (LE 233729:c); on *S. subcoralloides*, *M. Zhurbenko 90816* (LE 233820); lower Pravaya Uboinaya River, "217" Mt., 73°26'N, 82°43'E, alt. 150 m, stony tundra, on *S. groenlandicum*, 5.viii.1990, *M. Zhurbenko 90836* (LE 233840); on *S. botryosum*, 5.viii.1990, *M. Zhurbenko 90832:a* (LE 233930:a); NW coast of Pyasino Lake, Nyapan Hills, 70°00'N, 87°30'E, alt. 100 m, snowbank in shrub tundra, on *S. glareosum*, 2.viii.1999, *L. Zanokha* (LE 233434); Byrranga Mts., N of Levinson-Lessinga Lake, 74°31'N, 98°36'E, alt. 180 m, pebble tundra along a stream, on *S. glareosum*, 26.viii.1995, *M. Zhurbenko 95236* (LE 233633); alt. 500 m, wet scree tundra, on *S. rivulorum*, 20.viii.1995, *M. Zhurbenko 9526* (LE 233623); S of Levinson-Lessinga Lake, 74°24'N, 98°46'E, alt. 150 m, tundra, on *S. rivulorum*, 1.viii.1995, *M. Zhurbenko 95433* (LE 233685). **EASTERN SAYAN MTS.:** Kryzhina Range, headwaters of Belyi Kitat River, 53°59'N, 95°33'E, alt. 1800 m, *Dryas* mountain tundra, on *S. paschale*, 23.vii.2009, *M. Zhurbenko 0935* (LE 260251); 5 km N of Mondy, 51°43'N, 101°00'E, alt. 2150 m, mountain tundra, on *S. glareosum*, 14.vi.2005, *M. Zhurbenko 05222:a* (LE 233779:a). **BAIKAL SIBERIA:** Khamar-Daban Range, Osinovka Mt., 51°30'N, 105°23'E, alt. 1500 m, stones in subalpine belt, on *S. symphycheilum*, 20.vii.1993, *M. Zhurbenko 937* (LE 233693). **MAINLAND YAKUTIYA:** Laptevykh Sea coast, 3 km NW of Tiksi, 71°39'N, 128°45'E, alt. 70 m, scree dwarf shrub tundra, on *S. depressum*, 24.viii.1998, *M. Zhurbenko 9831* (LE 233603); on *S. groenlandicum*, 24.viii.1998, *M. Zhurbenko 986* (LE 233673); same coast, 3 km SW of Tiksi, 71°40'N, 128°40'E, alt. 50 m, scree dwarf shrub tundra, on *S. intermedium*, 17.vii.1998, *M. Zhurbenko 9851* (LE 233653); on *S. rivulorum*, 17.vii.1998, *M. Zhurbenko 9845* (LE 233643); middle Indigirka River, 8 km SW of Ust'-Nera, 64°31'N, 143°08'E, alt. 1200 m, rocks in alpine belt, on *S. vesuvianum*, 23.vii.1992, *M. Zhurbenko 92501* (LE 207712); same river, Momskie Rapids, 65°42'N, 142°39'E, alt. 300 m, stone field in *Larix* forest, on *S. intermedium*, 19.vii.1992, *M. Zhurbenko 92559* (LE 233645). **NEW SIBERIAN ISLANDS:** Bennetta Is. [all in stony arctic desert], Zeberga Glacier, ca. 76°40'N, 149°00'E, alt. 160 m, on *S. depressum*, 10.vii.1989, *M. Zhurbenko 8987* (LE 233695); on *S. groenlandicum*, 11.vii.1989, *M. Zhurbenko 8988* (LE 233624), 12.vii.1989, *M. Zhurbenko 8976* (LE 207690). **WRANGEL' IS.:** locality and date unknown, tundra, on *S. rivulorum*, *S. Kholod* (LE 233574).

5. *Dactylospora deminuta* (Th. Fr.) Triebel

NOTES. – This fungus grows on a wide range of unrelated lichen genera, and was recently reported from *Stereocaulon* (Zhurbenko 2009a). It has been found growing commensalistically on *Stereocaulon* stems and on adjacent thalli of *Lecanora epibryon* and *Pertusaria octomela*.

SPECIMEN EXAMINED. – **RUSSIA. MAINLAND YAKUTIYA:** Lena River delta, 3 km E of Krest-Tumsa Cape, 72°22'N, 126°42'E, alt. 50 m, stony *Dryas* tundra, on *Stereocaulon depressum*, 4.viii.1998, *M. Zhurbenko 9835* (LE 233512).

6. **Diploschistes muscorum* (Scop.) R. Sant.

NOTES. – This is a common terricolous lichen frequently growing on *Cladonia* and occasionally other lichen genera, such as *Parmelia, Physconia* and *Stereocaulon* (Hafellner 1994, Lumbsch 1989, Rambold & Triebel 1992, Suija 2005a). It has been found on phyllocladia and sometimes stems of *S. alpinum, S. depressum, S. groenlandicum, S. rivulorum* and *S. subcoralloides*.

SPECIMENS EXAMINED. – **RUSSIA. NENETS REGION:** Bol'shezemel'skaya Tundra, Ortin River, Vorgashor Stream, 67°50'N, 54°03'E, dwarf shrub tundra, on *S. rivulorum*, 29.vi.1999, *O. Lavrinenko* (LE 233484:c). **POLAR URAL:** Sob' River at 129 km of the railway Vorkuta-Labytnangi, 66°59'N, 65°45'E, alt. 300 m, boulders in *Alnus* shrubs, on *S. subcoralloides*, 11.vii.1986, *M. Zhurbenko 8691* (LE 207701). **TAIMYR PEN.:** Byrranga Mts., S of Levinson-Lessinga Lake, 74°24'N, 98°46'E, alt. 50 m, pebble along lake bank, on *S. depressum*, 31.vii.1995, *M. Zhurbenko 95435* (LE 233511). **PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 150 m, boulders in *Larix* forest, on *S. subcoralloides*, 17.vii.1985, *M. Zhurbenko 8582* (LE 207659); alt. 800 m, mountain tundra, on *S. groenlandicum*, 21.vii.1985, *M. Zhurbenko 8580* (LE 207658); same plateau, S of Ayan Lake, 69°00'N, 94°15'E, alt. 900 m, subalpine belt, on *S. alpinum*, 29.viii.1984, *M. Zhurbenko 84314* (LE 233730). **MAINLAND YAKUTIYA:** Laptevykh Sea coast, 3 km SW of Tiksi, 71°40'N, 128°40'E, alt. 50 m, dwarf shrub tundra, on *S. rivulorum*, 17.vii.1998, *M. Zhurbenko 9847* (LE 233491); middle Indigirka River, 8 km SW of Ust'-Nera, 64°31'N, 143°08'E, alt. 700 m, stone field in *Larix* forest, on *Stereocaulon* sp., 23.vii.1992, *M. Zhurbenko 92505* (LE 233501).

7. *Endococcus nanellus* Ohlert

NOTES. – Ascomata perithecial, subglobose, ostiole not always distinct, black, glossy, sessile to ¾ immersed, (50–)100(–150) µm diam., dispersed. Peridium dark brown, K+ dark olive, BCr+ blue-green. Hamathecium not observed. Hymenial gel I– or I+ vanishing pale red-purple. Asci subcylindrical, not or slightly inflated in the center, with rounded apices, ocular chamber distinct, (30–)33–46(–52) × (5–)7–9(–11) µm (n = 62 in water or I), wall I–, K/I+ pale blue with darker blue apical spot, 8-spored. Ascospores narrowly soleiform to fusiform, often tapering towards apices, occasionally oblong ellipsoid to even broadly ellipsoid, (0–)1-septate [one abnormal 2-septate ascospore also seen], not or slightly constricted at the septum, upper cell usually slightly broader than the lower one, straight or occasionally slightly curved, smooth-walled, without halo, often with oil droplets, at first hyaline then usually pale grey-olive to olivaceous buff (colouration better seen in KOH), (6–)9–12(–16) × (2–)3–4(–5) µm, l/b = (1.7–)2.6–3.7(–5.5) (n = 293), wall BCr–, sporoplast BCr+ blue, overlapping and inclined, uni- to biseriate in the asci. Conidiomata not observed.

In the protologue of *Endococcus nanellus* the asci were erroneously reported as polysporous (Ohlert 1870). However, they are 6–8-spored in the type (H-Nyl.), which is also indicated on its original label in the handwritting of O. Ohlert (V. Alstrup, pers. comm.).

Found on phyllocladia, sometimes stems, apothecia (usually by their margins) or cephalodia of *Stereocaulon alpestre, S. alpinum, S. botryosum, S. glareosum, S. grande, S. myriocarpum, S. paschale* and *S. tomentosum* (most common on this host). Often abundant, but macroscopically visible damage to the host was not observed. Sometimes grows on bleached apothecia, however evidently does not cause their discolouration, as many bleached apothecia were observed without the fungus. *Stereocaulon alpestre, S. alpinum, S. botryosum, S. glareosum* and *S. myriocarpum* are new host species. Most common in boreal forests, but occurs northwards to arctic deserts. New to Kazakhstan, Alaska, Greenland, Nenets Region, Central Ural, Evenkiya, Sayan Mts., Tuva, Magadan Region and Khabarovsk Territory.

Specimens Examined. – **U.S.A. Alaska:** middle Kobuk River at junction with Kavet Creek, 67°07'N, 159°03'W, alt. 50 m, *Picea* forest, on *Stereocaulon* sp., 8.viii.2000, *M. Zhurbenko 00144* (LE 210491); Tanana River flood plain, Bonanza Creek, 64°51'N, 147°49'W, alt. 130 m, *Picea* forest, on *S. tomentosum*, 21.viii.2004, *M. Zhurbenko 04259* (LE 210471); Fairbanks, Ballaine Lake, 64°32'N, 147°29'W, *Picea* forest, on *S. tomentosum*, 15.viii. 2004, *M. Zhurbenko 04144* (M); vicinities of Fairbanks, Morphy Dome, 64°57'N, 148°21'W, mountain shrub tundra, on *Stereocaulon* sp., 27.viii.2000, *M. Zhurbenko 00231* (LE 210481); Wrangell-Saint Elias Park and Preserve, Nizina River, 61°21'N, 142°46'W, alt. 422 m, *Dryas* tundra, on *S. alpinum*, 18.vii.2004, *J. Roth* (LE 210451). **CANADA. British Columbia:** Wells Gray Provincial Park, Spahats Creek, 51°44'N, 120°00'W, alt. 770 m, forested sandy roadside, on *S. tomentosum*, 10.vii.2002, *M. Zhurbenko 02265* (LE 233662); same park, Philip Creek Trail, 52°52'N, 120°00'W, alt. 800 m, forested sandy roadside, on *S. tomentosum*, 30.vii.2002, *M. Zhurbenko 02299* (LE 233652). **GREENLAND.** Mellem Land, 2 km NE of Narsarsuaq, 61°11'N, 45°23'W, alt. 40 m, shrub tundra, on *S. alpestre*, 24.vii.2005, *M. Zhurbenko 05292* (LE 233909). **RUSSIA. Karelia:** 160 km of road Kalevala-Kem', mixed forest, on *S. grande*, 19.vii.1986, *A. Dombrovskaya* (LE 207669). **Nenets Region:** Bol'shezemel'skaya Tundra, Khar'yaga oilfield, 67°12'N, 56°41'E, alt. 70 m, *Betula nana* tundra, on *S. alpinum*, 21.vii.2007, *M. Zhurbenko 0720* (LE 210436); 67°11'N, 56°30'E, alt. 70 m, forest-tundra, on *S. tomentosum*, 25.vii.2007, *M. Zhurbenko 0719* (LE 210388). **Central Ural:** Sverdlovskaya Oblast', Ivdel'skii Region, Polovinnyi Uval, mountain coniferous forest, on *S. tomentosum*, 21.viii.1955, *Z. Smirnova* (LE 233586, M). **Severnaya Zemlya:** Bol'shevik Is., Mushketova Glacier, 79°11'N, 102°09'E, alt. 200 m, stony arctic desert, on *S. botryosum*, 11.vii.1996, *M. Zhurbenko 96112:a* (LE 233572:a). **Taimyr Pen.:** Eniseyskii Gulf coast, Ragozinka River mouth, 72°48'N, 80°53'E, alt. 20 m, stone field in dwarf shrub tundra, on *S. botryosum*, 12.vii.1990, *M. Zhurbenko 90820* (LE 233780); same coast, Osipovka River, 72°42'N, 80°51'E, alt. 40 m, rocks in dwarf shrub tundra, on *S. botryosum*, 18.vii.1990, *M. Zhurbenko 901150* (LE 233739); lower Pravaya Uboinaya River, "217" Mt., 73°26'N, 82°43'E, alt. 150 m, stony tundra, on *S. botryosum*, 5.viii.1990, *M. Zhurbenko 90821* (LE 233980); Byrranga Mts., N of Levinson-Lessinga Lake, 74°31'N, 98°36'E, alt. 120 m, stony tundra, on *S. botryosum*, 26.viii.1994, *M. Zhurbenko 94502* (LE 210421); same Mts., Bikada River, ca. 74°50'N, 106°45'E, alt. 450 m, nival tundra, on *S. botryosum*, 1998, *E. Pospelova* (LE 261543). **Putorana Plateau:** Nyakshinda River, ca. 67°00'N, 93°15'E, alt. 400 m, *Larix* forest, on *S. tomentosum*, 17.vii.1970, *V. Kuvaev* (LE 233556); N of Verkhnee Agata Lake, ca. 67°02'N, 92°20'E, alt. 610 m, mixed forest, on *S. tomentosum*, 30.vii.1970, *V. Kuvaev* (LE 233546); E of Tembenchi Lake, ca. 66°45'N, 95°05'E, alt. 490 m, *Larix* forest, on *S. tomentosum*, 16.viii.1970, *V. Kuvaev* (LE 233426). **Evenkiya**: Turukhanskii Krai, on *S. tomentosum*, 1932, *A. M. Rubin* (LE 233612). **Tuva:** Tannu-Ola Range, junction of Chaa-Khol' and Sailik-Khem Rivers, *Larix* forest, on *S. alpestre*, 9.viii. 1946, *A. Schreter* (LE 233552). **Eastern Sayan Mts.:** Kryzhina Range, headwaters of Belyi Kitat River, 53°59'N, 95°30–32'E, alt. 1500–1550 m, carbonate rocks in mountain tundra, on *S. myriocarpum*, 22.vii.2009, *M. Zhurbenko 0933* (LE 260071); open rocks in sparse *Pinus sibirica-Abies sibirica* forest, on *S. myriocarpum*, 24.vii.2009, *M. Zhurbenko 0928* (LE 260161); 3 km N of Oka Lake, 51°55'N, 100°40'E, alt. 2000 m, shrub tundra, on *S. tomentosum*, 15.vi.2005, *M. Zhurbenko 05173* (LE 233799). **Baikal Siberia:** 2 km SE of Anchuk, Bol'shaya Bystraya River, 51°44'N, 103°29'E, alt. 700 m, pebble river bank with shrubs, on *S. glareosum*, 9.vi.2005, *M. Zhurbenko 0552* (LE 233562); Khamar-Daban Range, lower Mishikha River, ca. 51°35'N, 105°30'E, *Pinus* forest, on *S. tomentosum*, 23.viii.1996, *I. Urbanavichene* (LE 207675); same range, lower Vydrinaya River, ca. 51°25'N, 104°37'E, on *S. tomentosum*, 7.ix.1996, *I. Urbanavichene* (LE 207674, LE 207720); Dzherginskii Reserve, Kovyli River valley, ca. 55°07'N, 111°30'E, alt. 900 m, *Larix* forest, on *S. tomentosum*, 9.vii.2002, *T. Kharpukhaeva* (LE 233672). **Mainland Yakutiya:** middle Indigirka River, Predporozhnyi, 65°00'N, 143°00'E, alt. 700 m, *Larix* forest, on *S. tomentosum*, 16.vi.1976, *I. Makarova* (LE 207737); 24.vi.1976, *I. Makarova* (LE 207670, 207734). **Magadan Region:** M. Gor'kii mine, 62°36'N, 150°18'E, on *S. alpinum*, 17.vii.1949, *A. Fisher* (LE 233674). **Khabarovsk Territory:** Dzhugdzhur Range, Chelasin River, Nel'kan, ca. 57°40'N, 136°10'E, on *S. tomentosum*, *Anonymous* (LE 233676). **KAZAKHSTAN.** Akmolinskaya Oblast', Kokchetavskii Uezd, Akylbai Rive valley near Borovoe, mixed forest, on *S. glareosum*, 11.vii.1913, *F. Semenov* (LE 210431).

8. *Endococcus rugulosus* Nyl. s. l.

Notes. – This is a widespread species growing on various saxicolous crustose lichens, mainly species of *Aspicilia* and *Rhizocarpon*. This ecology fits its occurrence on crustose saxicolous *Stereocaulon plicatile*, formerly referred to *Rhizocarpon*. *Stereocaulon* is a new host genus. Pathogenicity not observed.

Specimen Examined. – **RUSSIA. Chukotka:** Sireniki, 64°24'N, 173°54'W, on stone in tundra, on thallus of *Stereocaulon plicatile*, 9.vii.1983, *I. Makarova* (LE 261600).

9. *Lasiosphaeriopsis stereocaulicola* (Linds.) O.E. Erikss. & R. Sant.

Notes. – Ascomata perithecial, ovoid to occasionally pyriform, 0.2–0.3(–0.5) mm diam., surface as a rule markedly rough and corrugate, immersed to sessile, black, sometimes with brownish hue, occasionally arising singly but mainly in compact groups of 5–40(–150) on dark hypostromata, often confluent in moriform clusters 1–3 mm diam. Ascospores elliptic to narrowly elliptic, occasionally narrowly oblong or subglobose, sometimes narrower and slightly attenuated below, straight to occasionally curved, (2–)4–6(–9)-transseptate, occasionally with oblique septa, sometimes markedly constricted at the septa, (13–)28.5–40.5(–50) × (6.5–)9–12(–17) µm, l/b = (1.0–)2.6–4.2(–5.4) (n = 111), smooth-walled, without perispore, at first hyaline, then olivaceous brown and finally dark brown, K+ olive, (2–)4(–6?) per ascus, uniseriate to diagonally biseriate.

Found on stems (mainly at the base), sometimes phyllocladia or cephalodia of *Stereocaulon alpinum, S. arcticum, S. arenarium, S. botryosum, S. depressum, S. glareosum, S. groenlandicum, S. intermedium, S. paschale* and *S. rivulorum.* In tomentose host species clusters of perithecia may include host tissue and thus look like globose galls. Infected host thalli occasionally become brownish, otherwise pathogenicity was not observed. *Stereocaulon arcticum* is a new host species. New to the U.S.A., British Columbia and Gydan Pen.

Specimens Examined. – **U.S.A. Alaska:** Wrangell-Saint Elias Park and Preserve, Mt. George, 60°59’N, 141°12’W, alt. 1783 m, alpine barren, on *S. alpinum*, 17.vii.2004, *T. Jorgenson* (LE 233427:b). **CANADA. Canadian Arctic Archipelago:** Ellesmere Is., Eureka, 80°06’N, 85°34’W, alt. 180 m, scree *Dryas* vegetation, on *S. depressum*, 30.vii.1999, *F. Daniels* (LE 210322:b); on *S. groenlandicum*, 31.vii.1999, *N. Matveeva* (LE 233614); Ellef Ringnes Is., Isachsen Bay, 78°48’N, 103°36’W, alt. 50 m, stony arctic desert, on *S. groenlandicum*, 25.vii.2005, *N. Matveeva* (LE 233596). **British Columbia:** Wells Gray Provincial Park, Raft Mt., 51°44’N, 119°50’W, alt. 2100 m, stony mountain tundra, on *S. intermedium*, 13.vii.2002, *M. Zhurbenko 02176* (LE 233979); same park, Raft Mt., 51°44’N, 119°50’W, alt. 2100 m, mountain tundra, on *S. alpinum*, 3.viii.2002, *M. Zhurbenko 02323* (LE 234000). **GREENLAND.** Mellem Land, 1 km NE of Narsarsuaq, Signalhojen Mt., 61°10’N, 45°24’W, alt. 100 m, shrub tundra, on *Stereocaulon* sp., 25.vii.2005, *M. Zhurbenko 05289* (LE 233939). **SVALBARD.** North-East Land, Murchison Fjorde, Nordvika, 80°03’N, 18°54’E, alt. 10 m, on *S. depressum*, 19.viii.2007, *N. Matveeva* (LE 210368); Nordenskiöld Land, W coast of Grønfjorden, Aldegondabreen Glacier, 78°00’N, 14°12’E, alt. 100 m, fellfield in tundra, on *S. groenlandicum*, 16.vii. 2003, *M. Zhurbenko 03269:b* (LE 233769:b). **NORWAY.** Troms County, Skibotndalen Valley, Lavkajavri, 69°13’N, 20°29’E, alt. 650 m, stony *Betula nana* tundra, on *S. depressum*, 8.viii.2003, *M. Zhurbenko 03117* (LE 233417). **RUSSIA. Polar Ural:** Rai-Iz Mt., 66°50’N, 65°05’E, alt. 565 m, tundra, on *S. alpinum*, 4.ix.2001, *S. Kholod* (LE 233602). **Gydan Pen.:** Gyda-yam Bay, Khasseinto-se River, 70°57’N, 79°09’E, on *S. alpinum*, 6.vii.1927, *B. Gorodkov* (LE 233526). **Tyva:** Todzhinskaya Depression, W of Kadysh Lake, 52°36‘N, 97°02‘E, alt. 1100 m, on *S. paschale* over mossy stone, 30.viii.1999, *T. Otnyukova* (LE 260203:a). **Severnaya Zemlya** [all in arctic desert]: Oktyabr’skoi Revolutsii Is., Peschanaya River, 79°39’N, 94°00’E, on *S. arcticum*, 29.vii.1985, *M. Gavrilo* (LE 233446); Goluboe Lake, 79°47’N, 97°34’E, on *S. groenlandicum*, 6.viii.1985, *M. Gavrilo* (LE 210383); Bol’shevik Is., Cape Antseva, 78°12’N, 103°17’E, alt. 30 m, on *S. botryosum*, 19.vii.2000, *N. Matveeva* (LE 210337); 16.vii.2000, *N. Matveeva* (LE 232167:a); on *S. rivulorum*, 23.vii.2000, *N. Matveeva* (LE 232186). **Taimyr Pen.:** Dikson Is., 73°30’N, 80°20’E, alt. 30 m, tundra, on *S. rivulorum*, 7.vii.1990, *M. Zhurbenko* 90893 (LE 233860); *M. Zhurbenko 90375* (LE 207707); Eniseyskii Gulf coast, Ragozinka River mouth, 72°48’N, 80°53’E, alt. 30 m, stony dwarf shrub tundra, on *S. alpinum*, 3.vii.1990, *M. Zhurbenko 90371* (LE 207692); on *S. depressum*, 12.vii.1990, *M. Zhurbenko 90369:a* (LE 207694:a); same coast, Osipovka River, 72°42’N, 80°51’E, alt. 40 m, boulders in dwarf shrub tundra, on *S. botryosum*, 18.vii. 1990, *M. Zhurbenko 90831:b* (LE 233709:b); on *S. groenlandicum*, 18.vii.1990, *M. Zhurbenko 90839:a* (LE 233729:a); lower Pravaya Uboinaya River, "217" Mt., 73°26’N, 82°43’E, alt. 150 m, stony tundra, on *S. groenlandicum*, 5.viii. 1990, *M. Zhurbenko 90907* (LE 233910); on *S. botryosum*, 5.viii.1990, *M. Zhurbenko 90894* (LE 233970); Byrranga Mts., N of Levinson-Lessinga Lake, 74°31’N, 98°36’E, alt. 400 m, scree tundra, on *S. botryosum*, 20.vii.1995, *M. Zhurbenko 9535* (LE 233646); S of Levinson-Lessinga Lake, 74°24’N, 98°46’E, alt. 50 m, pebble along lake bank, on *S. depressum*, 31.vii.1995, *M. Zhurbenko 9514* (LE 233516); Khatanga, 71°58’N, 102°27’E, forest-tundra, on *S. alpinum*, 4.ix.1995, *M. Zhurbenko 9513:b* (LE 233462:b). **Putorana Plateau:** Kholokit Mt., 69°10’N, 94°40’E, alt. 1200 m, stony mountain tundra, on *S. depressum*, 7.viii.1967, *N. Lovelius* (LE 233476). **Mainland Yakutiya:** lower Lena River, Kharaulakh Range, Yuryung-Kysam Urochishche opposite Tit-Ary Is., 71°59’N, 126°19’E, alt. 150 m, rocks in tundra, on *S. groenlandicum*, 19.viii.1998, *M. Zhurbenko 984* (H, LE 233576); Laptevykh Sea coast [all in dwarf shrub tundra], 3 km NW of Tiksi, 71°39’N, 128°45’E, alt. 70 m, on *S. alpinum*, 24.viii.1998, *M. Zhurbenko 983* (LE 233406); on *S. depressum*, 24.viii.1998, *M. Zhurbenko 98322:b* (LE 233452:b); 1 km S of Tiksi, 71°37’N, 128°54’E, alt. 70 m, on *S. rivulorum*, 18.vii.1998, *M. Zhurbenko 9833* (LE 233496); 3 km SW of Tiksi, 71°40’N, 128°40’E, alt. 50 m, on *S. rivulorum*, 17.vii.1998, *M. Zhurbenko 9843* (M); middle Indigirka River, 8 km SW of Ust-Nera, 64°31’N, 143°08’E, alt. 1000 m, stone field in subalpine belt, on *S. intermedium*, 23.vii.1992, *M. Zhurbenko 92513:c* (LE 207724:c). **New Siberian Islands:** Bennetta Is. [all in stony arctic desert], Zeberga Glacier, ca. 76°40’N, 149°00’E, alt. 180 m, on *S. depressum*, 11.vii.1989, *M. Zhurbenko 8970* (LE 207661); 13.vii.1989, *M. Zhurbenko 8985* (LE 233686); on *S. groenlandicum*, 12.vii.1989, *M. Zhurbenko 8987* (LE 233626); 10.vii.1989, *M. Zhurbenko 8980* (LE 207682); 8.vii.1989, *M. Zhurbenko 8968* (LE 207641); 26.vii.1989, *M. Zhurbenko 8969* (LE 207646). **Wrangel’ Is.** [all in tundra]**:** Gusinaya River, ca. 71°06’N, 179°07’E, alt. 280 m, on *S. rivulorum*, 5.viii.1991, *V. Shtrik* (LE 233666); Tundra Akademii, lower Neizvestnaya River, ca. 71°11’N, 179°15’W, on *S. rivulorum*, 1986, *A. Dobrysh* (LE 233566); Krasnyi Flag River, ca. 71°30’N, 178°55’W, on *S. rivulorum*, 19.viii.1938, *B. Gorodkov* (LE 233466);

Gusinaya River, 71°08'N, 179°10'E, on *S. arenarium*, 1991, *S. Kholod* (LE 233636); Neozhidannaya River, 70°59'N, 179°14'E, alt. 110 m, on *S. botryosum*, 14.viii.1992, *S. Kholod* (LE 233696). **CHUKOTKA:** Anyui Upland, middle Kytep-Guiten'ryveem River, Baranii Stream, on *S. glareosum*, 18.viii.1977, *V. Petrovskii* (LE 233416).

10. *Lichenopeltella stereocaulorum* Zhurb. sp. nov.

Mycobank #516536.

PLATE 2 (PAGE 19).

Fungus lichenicolus in thallis lichenum generis *Stereocauli* crescit. Similis *Lichenopeltellae cladoniarum,* sed ab ea imprimis differt ascosporis minoribus (11–)13–16.5(–18) × 4–5(–6) µm et hospite diverso.

TYPE: RUSSIA, Wrangel' Is., Gusinaya River, 71°11'N, 179°09'E, alt. 475 m, boulder field, on *Stereocaulon botryosum* (mostly naked stems, also adjacent cephalodia and phyllocladia), 24.vii. 1991, *S. Kholod* (LE 210362, holotype).

DESCRIPTION. – *Vegetative hyphae* not observed. *Ascomata* catathecial, cone-shaped, with distinct longitudinal ribs, sometimes truncated above, brown at the beginning then dark brown to black, glossy, 50–100 µm diam., 30–100 µm tall, superficial or sometimes partly immersed in host's tomentum, ostiole without setae, not raised, 10–15(–50) µm diam., dispersed or sometimes aggregated. *Ascomatal wall* dark brown, one cell thick, composed of radially arranged, more or less quadrangular to elongated cells 4–12 × 3–5 µm, occasionally above with perforations 1–2 µm diam., with darker brown intercellular ribs, robust, 1–2(–3) µm thick, K+ olive, BCr+ blue-green. *Paraphyses* not observed. *Asci* bitunicate, tholus 2–6 µm tall, narrowly elliptic to oblong and often slightly inflated in the center or below, foot short or sometimes absent, (26–)34–44(–50) × (10–)11–15(–19) µm, l/b = (1.8–)2.4–3.6(–4.2) (n = 58), 8-spored, I–, K/I–, BCr–. *Ascospores* hyaline, soleiform with broader upper cell to occasionally almost fusiform, rounded at the apices, straight to occasionally slightly curved, 1-septate, not or slightly constricted at the septum, without setulae, usually with 1–2 large guttules in each cell, wall smooth, up to 1 µm thick, without halo, (11–)13–16.5(–18) × 4–5(–6) µm, l/b = (2.2–)2.7–3.7(–4.5) (n = 108) [in LE 207651 ascospores were longer: (15–)16–18 × 4–5(–5.5) µm (n = 30)], overlapping biseriate in the asci. *Conidiomata* not observed.

ETYMOLOGY. – Dwelling on *Stereocaulon*.

MATRIX AND BIOLOGY. – On stems (both tomentose and naked portions, usually at the base), occasionally adjacent phyllocladia or cephalodia of *Stereocaulon alpinum*, *S. botryosum*, *S.* cf. *depressum*, *S. groenlandicum*, *S. paschale*, *S. rivulorum* and undetermined *Stereocaulon* spp. In LE 207651 fungal ascomata grew on *S. rivulorum* and also on adjacent sand grains (this specimen with larger ascospores was reported by Zhurbenko (2001: 36) as "*Lichenopeltella cladoniarum*"). Pathogenicity not observed.

DISTRIBUTION. – Known from Europe (Russia), Asia (Russia) and North America (Canada). Most collections are from various tundra biomes, while two are from arctic desert and mountain taiga forest.

OBSERVATIONS. – Among the 38 described species of *Lichenopeltella* (Index Fungorum 2009), most of which are keyed in Aptroot et al. (1997), none are known from Stereocaulaceae (Lecanorales). The new species is most similar to *L. cladoniarum* E.S. Hansen & Alstrup and *L. heterodermiicola* M.S. Cole & D. Hawksw. However, the ascospores of *L. cladoniarum* are longer, 18–21 × 5–6 µm, while ascospores of *L. heterodermiicola* are shorter, 13–14.5 × 3.5–5 µm. Both species grow on hosts from different families – Cladoniaceae (also Lecanorales) and Physciaceae (Teloschistales) respectively (Cole & Hawksworth 2002, Hansen & Alstrup 1995).

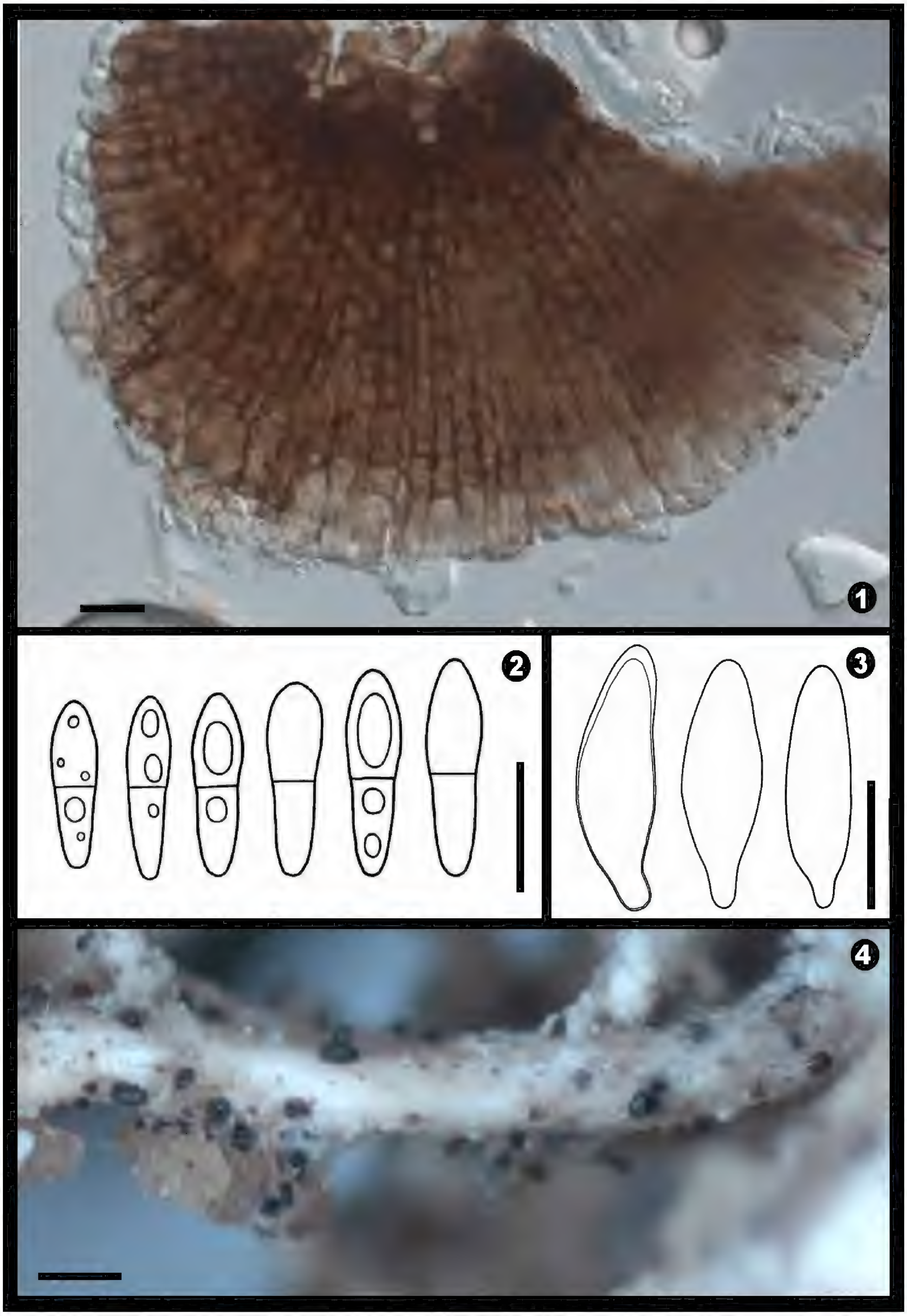

Plate 2. *Lichenopeltella stereocaulorum* Zhurb. (all from LE 210362). Figure 1, ascomata wall (scale = 10 µm). Figure 2, ascospores (scale = 10 µm). Figure 3, asci (scale = 20 µm). Figure 4, ascomata (scale = 200 µm).

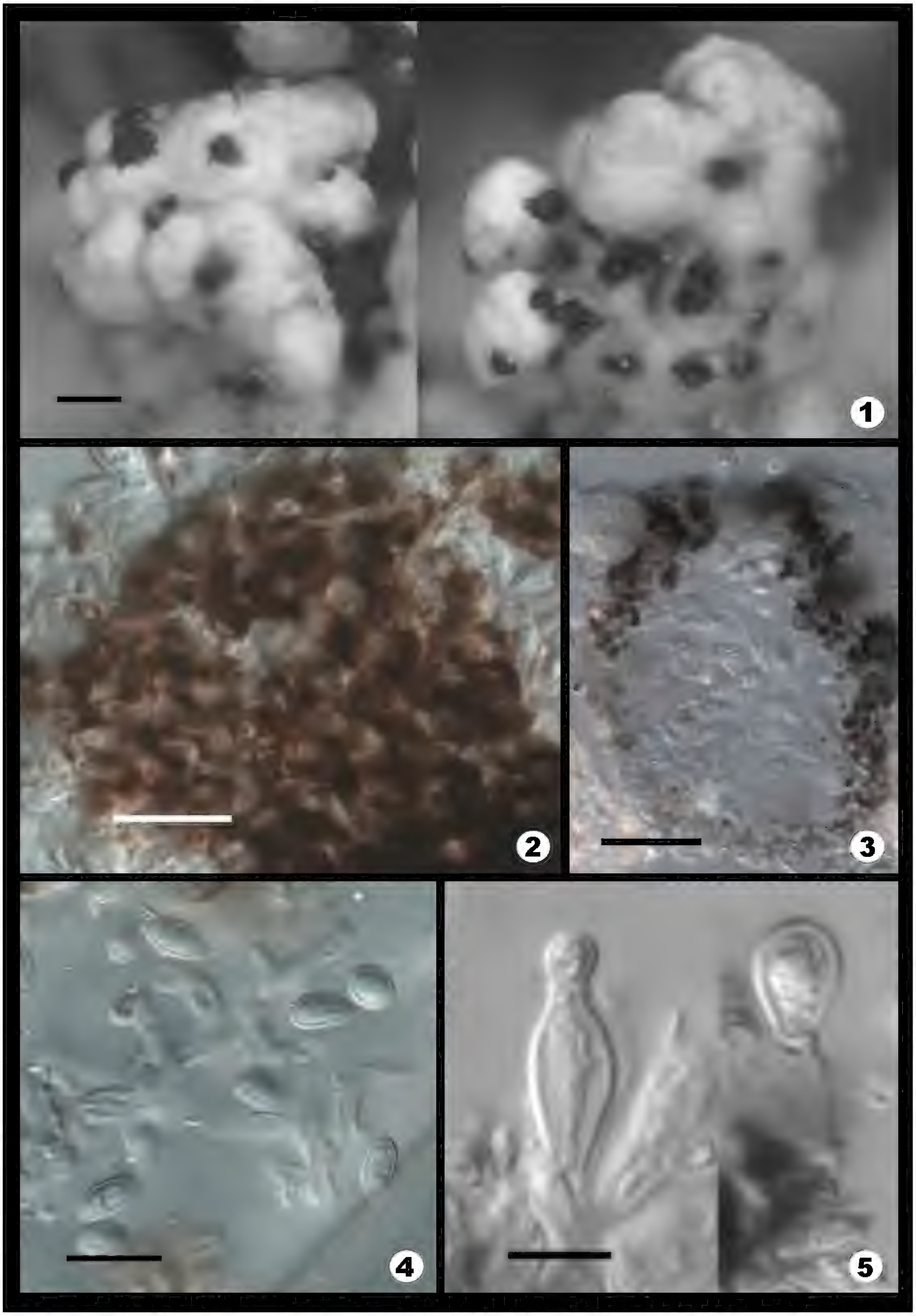

Plate 3. *Lichenosticta dombrovskae* Zhurb. (all from LE 207733). Figure 1, pycnidia (scale = 100 µm). Figure 2, pycnidial wall (scale = 10 µm). Figure 3, pycnidium in cross section (scale = 20 µm). Figure 4, conidiogenous cells and conidia (scale =10 µm). Figure 5, conidiogenous cells (scale = 5 µm).

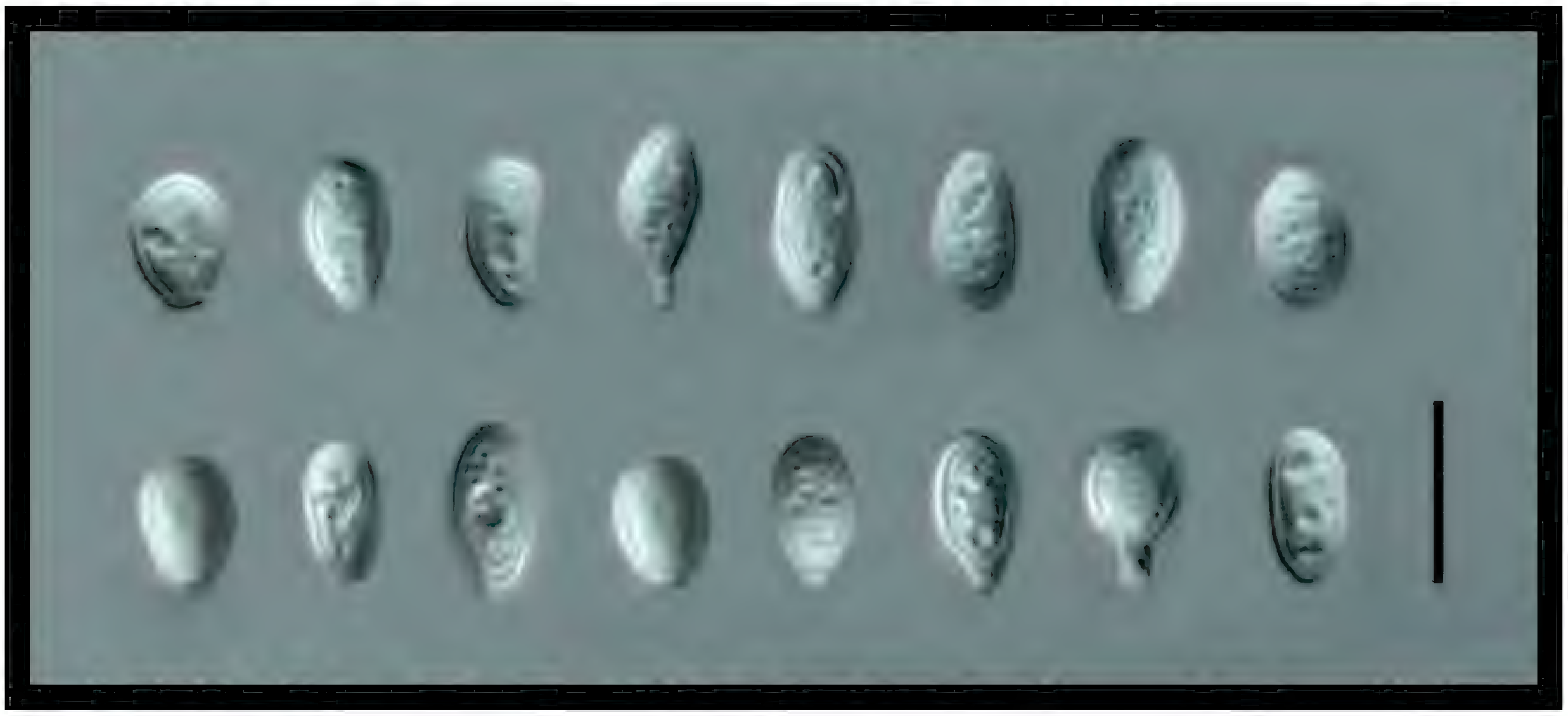

Plate 4. Conidia of *Lichenosticta dombrovskae* Zhurb. (from LE 207733; scale = 10 µm).

Additional Specimens Examined. – **CANADA. Canadian Arctic Archipelago:** Ellesmere Is., Sverdrup Pass, 79°08'N, 81°27'W, alt. 330 m, dwarf shrub tundra, on *S. alpinum*, 24.vii.1992, *F. Daniels* (LE 210382); same island, Eureka, 80°04'N, 85°29'W, alt. 900 m, arctic desert, on *Stereocaulon* sp., 30.vii.1999, *F. Daniels* (LE 233637). **RUSSIA. Murmansk Region:** Barents Sea coast, Voron'ya River mouth, 69°09'N, 35°50'E, alt. 10 m, dwarf shrub tundra, on *S. rivulorum*, 30.viii.1997, *M. Zhurbenko 9763* (LE 207651); same coast, 17 km N of Tumannyi, 69°01'N, 35°46'E, alt. 100 m, *Betula nana* tundra, on *S. paschale*, 10.ix.1997, *M. Zhurbenko 97301* (LE 210392). **Taimyr Pen.:** Byrranga Mts., N of Levinson-Lessinga Lake, 74°31'N, 98°27'E, alt. 450 m, scree tundra, on *S.* cf. *depressum*, 10.viii.1995, *M. Zhurbenko 956* (LE 233647a); Bol'shaya Bootankaga River, 74º20'N, 98°05'E, alt. 450 m, stony mountain desert, on *S. groenlandicum*, 8.vii.1991, *V. Kuvaev* (LE 207735). **Evenkiya:** Chunya River, 61°40'N, 96°30'E, alt. 500 m, taiga forest, on *Stereocaulon* sp., 1931, *A. Rubin* (LE 233657). **Baikal Siberia:** Khamar-Daban Range, Osinovka Mt., 51°30'N, 105°23'E, alt. 1500 m, stone field in subalpine belt, on *Stereocaulon* sp., 20.vii.1993, *M. Zhurbenko 938* (LE 210412). **Mainland Yakutiya:** Kolyma River delta, Pokhodskoe, 69°04'N, 160°57'E, low shrub tundra, on *Stereocaulon* sp., 9.vii.1905, *I. Shul'ga* (LE 233627). **Wrangel' Is.:** Neozhidannaya River, 71°03'N, 179°12'E, alt. 380 m, scree tundra, on *Stereocaulon* sp., 19.viii.1992, *S. Kholod* (LE 233617:a).

11. *Lichenosticta dombrovskae* Zhurb. sp. nov.

Mycobank # 516537.

Plates 3-4 (Pages 20-21).

Fungus lichenicolus in thallis lichenum generis *Stereocauli* crescit. Similis *Lichenostictae alcicornariae,* sed ab ea imprimis differt conidia haud lacriformia et hospite diverso.

Type: RUSSIA, Taimyr Pen., Byrranga Mts., middle Bol'shaya Bootankaga River, 74°20'N, 98°05'E, alt. 400 m, stony dwarf shrub tundra, on *Stereocaulon alpinum* (phyllocladia, occasionally stems), 10.vii.1991, *V. Kuvaev* (LE 207733, holotype).

Description. – *Conidiomata* pycnidial, subglobose, 50–100(–125) µm diam., with ostiole 10–20 µm diam., black, glossy, initially immersed in the thallus of the host lichen later becoming partially erumpent, dispersed to aggregated, occasionally adjacent to confluent. *Pycnidial wall* composed of a few layers of pseudoparenchymatous cells, ca. 10 µm thick, brown, thicker and darker above, in surface view resembling textura angularis, of thick-walled cells 4–8 × 3.5–6 µm. *Conidiophores* arising from the inner wall of pycnidium, hyaline, flexuous, irregularly branched. *Conidiogenous cells* enteroblastic, phialidic, percurrent proliferation not observed, cylindrical to elongate-doliiform, hyaline. *Conidia* acropleurogenous, often abundant, arising singly, simple, hyaline, elliptic, occasionally almost oblong, narrowly or broadly elliptic or circular, rarely slightly curved, often slightly to strongly attenuated at the base (thus sometimes pyriform), rounded at the apex, base often distinctly truncated and (1–)1.5–2 µm wide, smooth-walled, 0.5–0.8 µm thick, guttulate, (4.5–)6.5–8.5(–11) × (3–)4–4.5(–5.5) µm, l/b = (1.0–)1.5–2.1(–2.8) (n = 150, in water or phloxin).

Etymology. – Named after Anna V. Dombrovskaya, the monographer of *Stereocaulon* in the former U.S.S.R. (Dombrovskaya 1996).

Matrix and Biology. – On phyllocladia, occasionally stems of *Stereocaulon alpinum*, *S. glareosum, S. groenlandicum* and *S. rivulorum*. Pathogenicity not observed.

Distribution. – Known from two localities in Siberia (Russia) within tundra and northern taiga biomes.

Observations. – The species is placed in the formerly monotypic genus *Lichenosticta* Zopf (Hawksworth 1981). It is very close to *Lichenosticta alcicornaria* (Linds.) D. Hawksw., which grows on various *Cladonia* species, but differs from by not having lacriform conidia and occurring on a different host genus and family (Cladoniaceae vs. Stereocaulaceae) within the same order Lecanorales.

Additional Specimens Examined. **RUSSIA. Taimyr Pen.:** Byrranga Mts., middle Bol'shaya Bootankaga River, 74°20'N, 98°05'E, alt. 460 m, tundra, on *S. rivulorum*, 10.vii.1991, *V. Kuvaev* (LE 207732, topotype). **Mainland Yakutiya:** middle Indigirka River, 8 km SW of Ust-Nera, 64°31'N, 143°08'E, alt. 700 m, stone field in sparse *Larix* forest, on *S. groenlandicum*, 23.vii.1992, *M. Zhurbenko 92504:a* (LE 207730:a); alt.1000 m, stone field in subalpine belt, on *S. glareosum*, 23.vii.1992, *M. Zhurbenko 92511* (LE 207722).

12. *Merismatium decolorans* (Arnold) Triebel

Notes. – Ascospores elliptic to narrowly elliptic, hyaline to pale grey, (1–)3(–4)-septate, (10–)12.5–15.5(–18) × (4–)5–5.5(–6) µm, l/b = (1.7–)2.4–3.0(–3.4) (n = 68). The fungus grows on various terricolous lichen genera, including *Stereocaulon*. It has been found mainly on stems, but also on cephalodia and phyllocladia of *Stereocaulon alpinum* and *S. glareosum*. Pathogenicity not observed. New to the Taimyr Pen.

Specimens Examined. – **RUSSIA. Taimyr Pen.:** NW coast of Pyasino Lake, Nyapan hills, 70°00'N, 87°30'E, alt. 100m, shrub tundra near snowbank, on *S. glareosum*, 2.viii.1999, *L. Zanokha* (LE 210312). **Putorana Plateau:** E of Sobach'e (Yt-Kyuel') Lake, 69°08'N, 91°55'E, alt. 900 m, mountain tundra, on *S. alpinum*, vii.1996, *N. Matveeva* (LE 207654).

13. *Niesslia peltigericola* (D. Hawksw.) Etayo

(syn. *Raciborskiomyces peltigericola* (D. Hawksw.) M.E. Barr)

Notes. – Ascomata perithecial, 75–100 µm diam., subglobose, ostiolate, black, ¾ immersed to nearly sessile, with straight setae of 37–50 × 3–5 µm. Asci bitunicate, 8-spored. Ascospores elliptic to narrowly elliptic with rather acute apices, hyaline to pale clay buff, (0–)1-septate, usually more or less constricted at the septum, smooth-walled, without halo, (12–)13.5–16.5(–20) × (4–)5–6.5(–8) µm, l/b = (1.9–)2.3–3.1(–3.6) (n = 82), diagonally biseriate in the asci.

This lichenicolous fungus has previously been reported only from *Peltigera* species. In the protologue (Hawksworth 1980) the ascospores are said to be hyaline and smaller (12–16 × 3.5–4.5 µm.) However, in specimens from *Peltigera* (the type host genus) examined for comparison the ascospore size is similar to our samples ((13–)14–17(–19) × (4–)4.5–5.5(–7) µm (n = 26)). The fungus was found on old and possibly moribund basal parts of stems and phyllocladia of *Stereocaulon depressum* and *S. rivulorum*. New to the Canadian Arctic Archipelago.

Specimens Examined. – **CANADA. Canadian Arctic Archipelago:** Ellesmere Is., Eureka, 80°06'N, 85°34'W, alt. 180 m, scree *Dryas* vegetation, on *Stereocaulon depressum*, 30.vii.1999, *F. Daniels* (LE 210322:a). **RUSSIA. Taimyr Pen.:** Dikson Is., 73°30'N, 80°20'E, alt. 30 m, stony tundra, on *S. rivulorum*, 7.vii.1990, *M. Zhurbenko* 90903:b (LE 233719:b).

Specimens growing on Peltigera examined for comparison. **RUSSIA. Taimyr Pen.:** Pyasina River mouth, Lidiya, ca. 74°05'N, 87°00'E, alt. 10 m, tundra, on thallus of *Peltigera aphthosa*, 7.vii.1993, *V. Kuvaev* (LE 207600); Byrranga Mts., N of Levinson-Lessinga Lake, 74°31'N, 98°36'E, alt. 200 m, tundra, on thallus of *Peltigera aphthosa*, 10.viii.1994, *M. Zhurbenko 94179* (LE 207599:a).

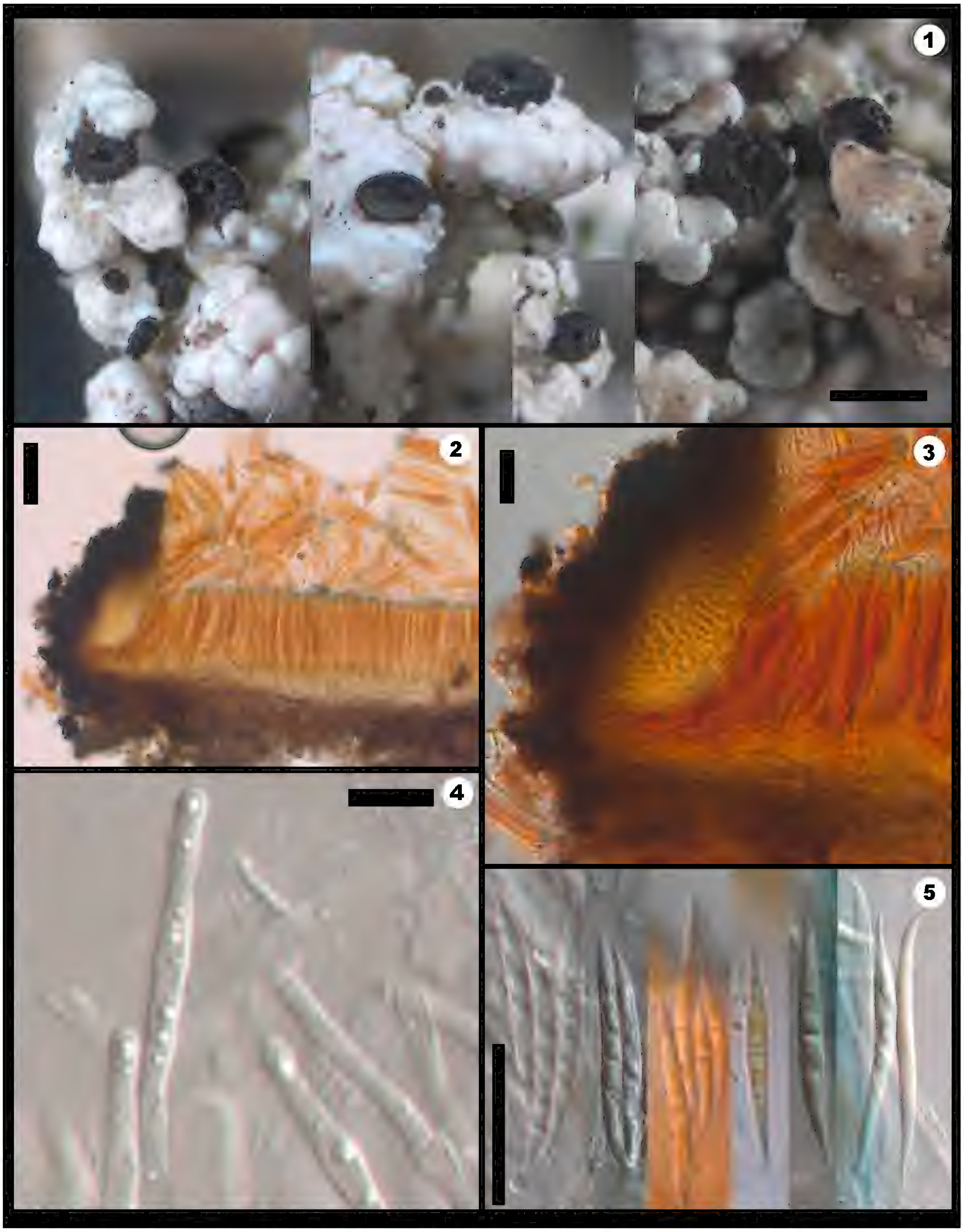

Plate 5. *Odontotrema stereocaulicola* Zhurb. (all from LE 261743). Figure 1, ascomata, including cross sectioned one in the center (scale = 0.5 mm). Figure 2, ascoma in cross section in I (scale = 50 µm). Figure 3, excipular margin with periphysoids in I (scale = 20 µm). Figure 4, paraphyses in K/I (scale = 5 µm). Figure 5, ascospores in K, I and K/I (scale = 20 µm).

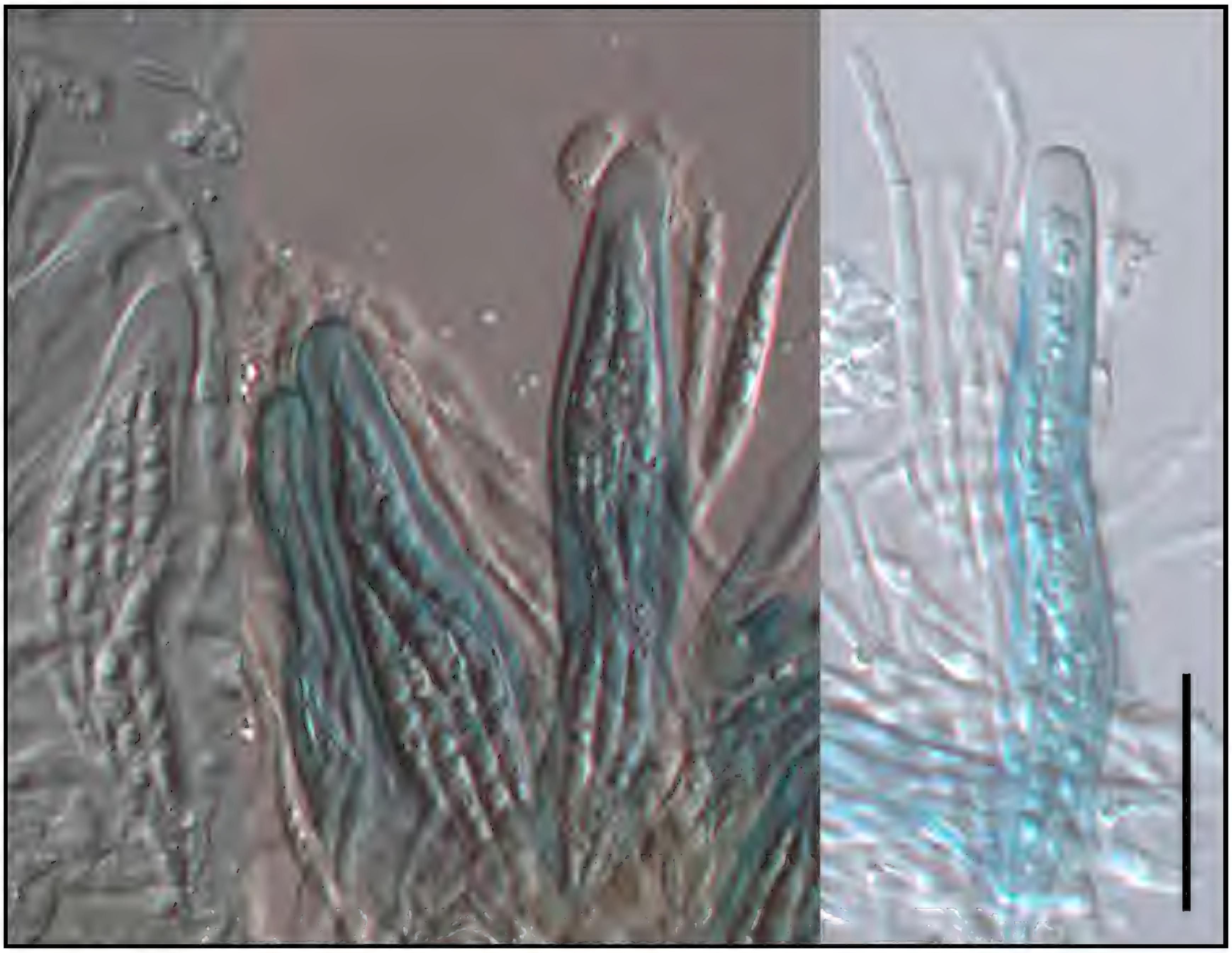

Plate 6. Asci and paraphyses of *Odontotrema stereocaulicola* in water and K/I (from LE 267143; scale = 20 µm).

14. *Odontotrema stereocaulicola* Zhurb. sp. nov.

Mycobank # 516538.

PLATES 5-6 (PAGES 23-24).

Fungus lichenicolus in thallis lichenum generis *Stereocauli* crescit. Similis ceteris *Odontotrematum* speciebus, sed ab eis imprimis differt ascosporis fusiformibus cum finibus attenuatis (22–)25.5–32.5(–38) × (2–)2.5–3(–3.5) µm et hospite diverso.

TYPE: RUSSIA, Murmansk Region, Khibiny Mts., near Akademicheskoe Lake, 67°43‘ N, 33°49‘ W, alt. 700 m, wet stony mountain tundra, on *Stereocaulon vesuvuanum* (phyllocladia), 20.viii. 2007, *M. Zhurbenko 0747* (LE 261743, holotype).

DESCRIPTION. – *Vegetative hyphae* indistinct. *Ascomata* cleistohymenial, subspherical to often flattened basally and above, 250–500 µm wide, 125–300 µm tall, blackish, rugose, initially seemingly completely closed, later with central pore, usually surrounded by distinct radial fissures, finally with wide opening exposing translucent grey disc, immersed to sessile, dispersed. *Exciple* cupulate, without hairs, olive brown throughout, slightly darker in exposed parts; at the margins 35–60 µm wide, in cross section of more or less polygonal cells 5–10 µm across; at the base 20–30 µm tall, of interwoven hyphae. Excipular pigment extracellular, not granulose, brown, K-, HNO_3+ brownish red. *Periphysoids* well-developed on the inner surface of marginal exciple, perpendicular to the surface, hyaline, 2–5 × 15–30 µm, septate, markedly constricted at the septa, I-, K/I- (but plasma I+ yellow-orange). *Epihymenium* hyaline. *Hymenium* hyaline, 60–75 µm high, K/I+ blue, I+ orange red to brownish red (not bluish then red), except ascal apices which are I+ pale blue. *Subhymenium* hyaline, 15–20 µm high. *Paraphyses* filiform, straight, 1–2.5 µm diam., with occasional guttules, unbranched, apically not or slightly thickened, septate, not or slightly constricted at the septa, cells (6–)10–15 µm long. *Asci* subcylindrical to narrowly obclavate/elliptic, apically rounded, (58–)59–67(–70) × (6–)7–11(–12) µm (n = 16, in I or K/I), tholus 3–6 µm tall, with a distinct ocular chamber, 8-spored, wall apically I+ pale blue, laterally I+ vinaceous red (evanescent blue coloration not observed), K/I+ blue throughout, plasma K/I+ brownish orange. *Ascospores* hyaline, acicular to fusiform with pointed ends, more or less straight, (22–)25.5–32.5(–38) × (2–)2.5–3(–3.5) µm, l/b = (8.3–)9.0–12.7(–18.0) (n = 49, in I, K/I, or K), (0–)1(–3 ?)-septate, not or rarely slightly constricted at the septa, septal tori not observed, often with 2–7 large guttules, wall smooth, perispore not observed, mostly arranged in the ascus in overlapping fascicles by 3–4. *Anamorph* not observed.

ETYMOLOGY. – Dwelling on *Stereocaulon*.

MATRIX AND BIOLOGY. – On healthy-looking phyllocladia or rarely stems of *Stereocaulon saxatile* and *S. vesuvianum*. Pathogenicity not observed.

DISTRIBUTION. – So far known only from the type locality in mountain tundra of the Khibiny Mts. on the Kola Peninsula (Fennoscandia).

OBSERVATIONS. – On the basis of its cleistohymenial ascomata the new species clearly belongs to Odontotremataceae D. Hawksw. & Sherwood, but it is included in the genus *Odontotrema* Nyl. with some hesitation (Diederich et al. 2002). The previously known *Odontotrema* species readily differ in having ellipsoid to elongate ascospores with non-pointed ends, which are also 1–2-seriate and have small septal tori. Additionally they are distinguished by a K+ olivaceous exciple and an ascus wall I+ evanescent bluish before red. However, similar variation of ascospore shape occurs in *Skyttea* Sherwood, D. Hawksw. & Coppins, in which most species have ellipsoid ascospores with rounded ends, while in *S. megalosporae* Diederich & Etayo they are falcate to sigmoid with pointed ends (Diederich & Etayo 2000). The other lichenicolous genera of Odontotremataceae with similar characters are *Paralethariicola* Calatayud, Etayo & Diederich and *Spirographa* Zahlbr. (Calatayud et al. 2001, Diederich 2004). *Paralethariicola* has ascospores of similar size, but they are (0–)3-septate and distinctly curved (mostly falcate); the genus further differs by the presence of excipular hairs, thicker paraphyses (2–3(–4) µm diam.) and by asci I+ red throughout with hemiamyloid apical ring. *Spirographa* has similar acicular, 1-septate ascospores but they are usually helicoid, its hymenium and asci are K/I-, and asci are apically only slightly thickened and have no distinct ocular chamber. The new fungus also resembles lichenicolous species of the genera *Llimoniella* Hafellner & Nav.-Ros., *Rhymbocarpus* Zopf, *Skyttea*, and *Unguiculariopsis* Rehm with dark urceolate apothecia (Diederich & Etayo 2000). However, all these genera have different ascoma ontogeny and no periphysoids. Additionally, *Llimoniella* differs from *O. stereocaulicola* in having a K/I- hymenium and asci, the latter with a hardly thickened apical wall. *Rhymbocarpus* differs by its greenish epihymenium, I- and K/I- hymenium and asci, the latter with an unthickened or only slightly thickened apical wall. *Skyttea* differs by its hairy exciple and I- and K/I- hymenium and asci. *Unguiculariopsis* differs by its hairy exciple and I- ascus wall.

ADDITIONAL SPECIMEN EXAMINED. – As admixture to holotype, on *Stereocaulon saxatile* (phyllocladia, rarely stems), 20.viii.2007, *M. Zhurbenko 0774* (LE 261753, topotype).

15. *Opegrapha stereocaulicola* Alstrup & D. Hawksw.

NOTES. – Ascomata apothecial, more or less circular, elliptic or lirelliform (branched or unbranched), emarginate, convex and usually constricted at the base, sometimes confluent, 0.5–4 × 0.5–1(–2) mm, glossy, at first medium brown then black, sometimes slightly white pruinose. Hymenium I+ reddish orange, hypothecium and exciple with I+ blue-green patches. Ascospores elliptic, narrowly elliptic or occasionally narrowly oblong, often narrower in lower half, with rounded ends, straight to slightly curved, long hyaline, finally becoming medium brown, (0–)3–5(–6)-septate, constricted at the septa, wall at first smooth, then verruculose, often with thin perispore when young, (13.5–)19.5–26(–33) × (4–)5–7(–8.5) µm, l/b = (2–)3.1–4.5(–5.3) (n = 140), biseriate in the asci. Conidia hyaline, bacilliform, 5–8 × 1–2 µm, produced in flask-shaped loculi completely immersed in *Opegrapha* ascomata at their excipular margins.

Some of the Russian records cited below have already been briefly mentioned in Karatygin et al. (1999), but were missed in the checklist of lichenicolous fungi of Russia (Zhurbenko 2007) and thus are repeated here. The species has been found on stems and rarely on phyllocladia of *Stereocaulon alpinum, S. arcticum*, *S. botryosum, S.* cf. *capitellatum*, *S. depressum*, *S. groenlandicum*, *S. paschale*, *S. rivulorum, S. subcoralloides* and *S. tomentosum*. Host tissues sometimes become darker, otherwise pathogenicity was not observed. *Stereocaulon groenlandicum*, *S. subcoralloides* and *S. tomentosum* are new host species. New to North America (except Greenland), Svalbard, and the Nenets Region.

Specimens Examined. – **U.S.A. Alaska:** Seward Pen., Nome, 64°33'N, 165°22'W, alt. 100 m, dwarf shrub tundra, on *S. alpinum*, 2.ix.2001, *O. Afonina* (LE 233525); Wrangell-Saint Elias Park and Preserve, Nizina River, 61°22'N, 142°46'W, alt. 420 m, on *S. tomentosum*, 18.vii.2004, *J. Roth* (LE 233849:b). **CANADA. Canadian Arctic Archipelago:** Axel Heiberg Is., Bunde Fjord, 80°30'N, 94°35'W, scree *Dryas* vegetation, on *S. rivulorum*, 1.viii.1999, *N. Matveeva* (LE 233544). **British Columbia:** Wells Gray Provincial Park, Raft Mt., 51°44'N, 119°50'W, alt. 2100 m, mountain tundra, on *Stereocaulon* sp., 3.viii.2002, *M. Zhurbenko 02339* (LE 233432). –**SVALBARD.** Nordenskiöld Land, W coast of Grønfjorden between Aldegondabreen Glacier and Brydebekken River mouth, 78°00'N, 14°12'E, alt. 20 m, scree dwarf shrub tundra, on *S. groenlandicum*, 15.vii.2003, *M. Zhurbenko 03267* (LE 233422). **RUSSIA. Nenets Region:** Bol'shezemel'skaya Tundra, Ortin River, Vorgashor Stream, 67°50'N, 54°03'E, dwarf shrub tundra, on *S. rivulorum*, 29.vi.1999, *O. Lavrinenko* (LE 233494) [with anamorph]. **Gydan Pen.:** Gyda-yam Bay, Khasseinto-se River mouth, 71°02'N, 79°42'E, mossy tundra, on *S. paschale*, 29.vi.1927, *B. Gorodkov* (LE 233435). **Tyva:** Todzhinskaya Depression, W of Kadysh Lake, 52°36'N, 97°02'E, alt. 1100 m, on *S. paschale* over mossy stone, 30.viii.1999, *T. Otnyukova* (LE 260203:b). **Taimyr Pen.:** Dikson Is., 73°30'N, 80°20'E, alt. 30 m, stony tundra, on *S. botryosum*, 7.vii.1990, *M. Zhurbenko 90827* (LE 233790); on *S. depressum*, *M. Zhurbenko 901147* (LE 233455); Eniseyskii Gulf coast, Ragozinka River mouth, 72°48'N, 80°53'E, alt. 30 m, rocks in dwarf shrub tundra, on *S. botryosum*, 14.vii.1990, *M. Zhurbenko 90830* (LE 233800); on *S. subcoralloides*, 14.vii.1990, *M. Zhurbenko 90814* (LE 233405); Uboinaya River mouth, 73°36'N, 82°22'E, alt. 15 m, stony tundra, on *S. depressum*, 11.viii.1990, *M. Zhurbenko 90899* (LE 233850); 31.vii.1990, *M. Zhurbenko 90898* (LE 233890); 1.viii.1990, *M. Zhurbenko 90904* (LE 233880); on *S. rivulorum*, 9.viii.1990, *M. Zhurbenko 90909:b* (LE 233900:b); on *S. alpinum*, 9.viii.1990, *M. Zhurbenko 90365* (LE 207684); lower Pravaya Uboinaya River, "217" Mt., 73°26'N, 82°43'E, alt. 150 m, stony dwarf shrub tundra, on *S. botryosum*, 5.viii.1990, *M. Zhurbenko 90905* (LE 233920); on *S. groenlandicum*, 5.viii.1990, *M. Zhurbenko 901149* (LE 233940); on *S. alpinum*, 5.viii.1990, *M. Zhurbenko 90366* (LE 207699); Byrranga Mts., W of Levinson-Lessinga Lake, 74°30'N, 98°30'E, alt. 130 m, rocks, on *S. botryosum*, 27.viii.1995, *M. Zhurbenko 9520* (M); S of Levinson-Lessinga Lake, 74°24'N, 98°46'E, alt. 120 m, rocks along Protochnyi Stream, on *S. botryosum*, 28.viii. 1995, *M. Zhurbenko 95431* (LE 233495) [only anamorph]; alt. 50 m, pebble along lake bank, on *S. botryosum*, 31.vii. 1995, *M. Zhurbenko 95428* (LE 233515); middle Bol'shaya Bootankaga River, 74°30'N, 97°45'E, alt. 200 m, rocks in tundra, on *S. botryosum*, 15.viii.1995, *M. Zhurbenko 95430* (LE 233535); alt. 380 m, rocks in tundra, on *S.* cf. *capitellatum*, 16.viii.1995, *M. Zhurbenko 9518* (LE 233485). **Mainland Yakutiya:** Lena River delta, Stolb Is., 72°24'N, 126°40'E, alt. 50 m, tundra, on *S. alpinum*, 12.viii.1998, *M. Zhurbenko 9810* (LE 233465); same delta, Samoilovskii (D'ieleekh Aryyta) Is., 72°22'N, 126°29'E, alt. 10 m, tundra, on *S. alpinum*, 15.viii.1998, *M. Zhurbenko 988* (LE 233536); same delta, Novyi Chai-Tumus cabin, 72°20'N, 125°40'E, alt. 20 m, dwarf shrub tundra, on *S. depressum*, 6.viii.1998, *M. Zhurbenko 98239* (LE 260063); same delta, Tumatskaya Channel, Yrbalakh-Aryta Is., 72°24'N, 126°30'E, alt. 10 m, on *S. arcticum*, 26.vii.1997, *Yu. Cherkasova* (LE 233445); lower Lena River, Kharaulakh Range, Yuryung-Kysam Urochishche opposite Tit-Ary Is., 71°59'N, 126°19'E, alt. 150 m, rocks in tundra, on *S. depressum*, 19.viii.1998, *M. Zhurbenko 9813* (LE 233616); Laptevykh Sea coast, 3 km NW of Tiksi, 71°39'N, 128°45'E, alt. 70 m, scree dwarf shrub tundra, on *S. depressum*, 24.viii.1998, *M. Zhurbenko 9814* (H, LE 233475); 3 km SW of Tiksi, 71°40'N, 128°40'E, alt. 50 m, dwarf shrub tundra, on *S. rivulorum*, 17.vii.1998, *M. Zhurbenko 9842* (LE 233506); on *S. alpinum*, 17.vii.1998, *M. Zhurbenko 9841* (LE 233415). **Chukotka:** N of Anyui Upland, headwaters of Kaneliveem River, stony *Dryas* tundra, on *S. botryosum*, 21.vii.1977, *V. Petrovskii* (LE 233456); Iskaten' Pass at 32 km of Egvekinot-Iul'tin road, 66°35'N, 179°10'W, tundra, on *S. rivulorum*, 22.viii.1971, *V. Kostina* (LE 233425).

16. *Phaeosporobolus alpinus* R. Sant., Alstrup & D. Hawksw.

Notes. – This lichenicolous fungus is very common in the Arctic and mainly grows on *Pertusaria* and *Ochrolechia* spp., but was also reported from a number of unrelated host genera. *Stereocaulon* is a new host genus. It has been found commensalistically growing on phyllocladia and stems of *S. depressum, S. paschale* and *S. saxatile*.

Specimens Examined. – **U.S.A. Alaska:** Denali National Park, Mt. Healy, 63°50'N, 149°00'W, alt. 600 m, shrub mountain tundra, on *S. paschale*, 29.viii.2000, *M. Zhurbenko 00325* (LE 233412). **RUSSIA. Polar Ural:** valley NE of Rai-Iz Mt., 66°57'N, 65°39'E, alt. 150 m, rocks in *Larix* forest, on *S. saxatile*, 27.vi.1993, *M. Zhurbenko 93114* (LE 232126); Rai-Iz Mt., 66°46'N, 65°13'E, alt. 320 m, stony dwarf shrub tundra, on *Stereocaulon* sp., 23.viii.2001, *S. Kholod* (LE 233720) [also on adjacent *Ochrolechia frigida*]. **Mainland Yakutiya:** Laptevykh Sea coast, 3 km NW of Tiksi, 71°39'N, 128°45'E, alt. 70 m, scree dwarf shrub tundra, on *S. depressum*, 24.viii.1998, *M. Zhurbenko 9830* (LE 233532).

17. *Polycoccum trypethelioides* (Th. Fr.) R. Sant.

Notes. – Ascomata perithecial, subglobose to broadly ovate, 0.15–0.45 mm diam., with ostiole 20-50 µm diam., black, glossy, almost completely immersed to occasionally up to ½ emergent when old, adjacent to confluent, tightly aggregated up to 200 on a gall, which thus sometimes looks moriform. Ascospores obpyriform to obovate, occasionally elliptic, (0–)1-septate, usually constricted at the septum, with markedly unequal cells (usually the lower one smaller), at first hyaline then olive to brown, guttulate, thick-walled, (12–)15–19(–22.5) × (7–)8.5–10.5(–12.5) µm, l/b = (1.3–)1.5–2.0(–2.8) (n = 138), (4–)8 per ascus, overlapping uni- to biseriate. Conidiomata pycnidial, black, subglobose, ostiolate, 50–100 µm diam., immersed to erumpent, crowded and intermixed with the ascomata. Conidiogenous cells holoblastic, arising from the pycnidial wall, subcylindrical to elongate-ampulliform and strongly tapered towards the apex, with 1–2 annelations, ca. 14–15 × 2.5-3.5 µm. Conidia simple, (narrowly) oblong to elliptic, with rounded apex and truncated base, hyaline, smooth-walled, (3.5–)4–5(–7) × 1.5–2 µm, l/b = (1.8–)2.3–3.4(–4.7) (n = 47).

Found on stems and occasionally on phyllocladia of *Stereocaulon alpestre, S. alpinum, S. condensatum, S. depressum, S. glareosum, S. grande, S. groenlandicum, S. intermedium, S. myriocarpum, S. paschale* and *S. rivulorum*. The species induces conspicuous swollen galls, which are at first the same colour as the host thallus, later often light brown, occasionally fawn- or cinnamon-brown, otherwise pathogenicity was not observed. *Stereocaulon alpestre, S. depressum, S. intermedium* and *S. myriocarpum* are new host species. New to the U.S.A., Nenets Region, Altai, Baikal Siberia, New Siberian Islands and Wrangel' Is.

Specimens Examined. – **U.S.A. Alaska:** Seward Pen., 7 km NE of Nome, Newton Peak, 64°33'N, 165°22'W, alt. 240 m, scree nival site among *Salix* shrubs, on *S. rivulorum*, 5.ix.2001, *M. Zhurbenko 0170:b* (LE 233561:b); on *S. glareosum*, 5.ix.2001, *M. Zhurbenko 0163* (LE 260193); 115 km NE of Fairbanks, Eagle Summit, 65°30'N, 145°27'W, alt. 1200 m, mountain scree dwarf shrub tundra, on *S. groenlandicum*, 11.ix.2001, *M. Zhurbenko 01638* (LE 233474); Denali National Park, headwaters of Hinnes Creek, 63°44'N, 149°07'W, alt. 1200 m, *Dryas* mountain tundra, on *S. groenlandicum*, 30.viii.2000, *M. Zhurbenko 00314:a* (LE 233665:a). **CANADA. British Columbia:** Wells Gray Provincial Park, Raft Mt., 51°44'N, 119°50'W, alt. 2100 m, mountain tundra, on *S. rivulorum*, 13.vii.2002, *M. Zhurbenko 02178* (LE 233989). **GREENLAND.** Mellem Land, 2 km NE of Narsarsuaq, 61°11'N, 45°23'W, alt. 40 m, scree roadside among shrub tundra, on *S. alpestre*, 24.vii.2005, *M. Zhurbenko 05291* (LE 233899). **SVALBARD.** Nordenskiöld Land, W coast of Grønfjorden, Aldegondabreen Glacier, 78°00'N, 14°12'E, alt. 100 m, stony dwarf shrub tundra, on *S. groenlandicum*, 16.vii.2003, *M. Zhurbenko 03269:a* (LE 233769:a). **RUSSIA. Karelia:** 160 km of road Kalevala-Kem', mixed forest, on *S. grande*, 19.vii.1986, *A. Dombrovskaya* (LE 207372). **Nenets Region:** Bol'shezemel'skaya Tundra, Ortin River, Vorgashor Stream, 67°50'N, 54°03'E, dwarf shrub tundra, on *S. rivulorum*, 29.vi.1999, *O. Lavrinenko* (LE 233484:a). **Polar Ural:** Rai-Iz Mt., 66°46'N, 65°13'E, alt. 320 m, stony dwarf shrub tundra, on *S. depressum*, 23.viii.2001, *S. Kholod* (LE 233710:a). **Severnaya Zemlya:** Oktyabr'skoi Revolutsii Is., Peschanaya River, 79°39'N, 94°00'E, on *S. rivulorum*, 20.vii.1985, *M. Gavrilo* (LE 233654). **Taimyr Pen.:** Uboinaya River mouth, 73°36'N, 82°22'E, alt. 20 m, scree tundra, on *S. glareosum*, 31.vii.1990, *M. Zhurbenko* 90891 (LE 233770) [only anamorph]; lower Pravaya Uboinaya River, "217" Mt., 73°26'N, 82°43'E, alt. 150 m, scree tundra, on *S. groenlandicum*, 5.viii.1990, *M. Zhurbenko 901148* (LE 233960); Byrranga Mts., N of Levinson-Lessinga Lake, 74°31'N, 98°36'E, alt. 450 m, scree tundra, on *S. groenlandicum*, 10.viii.1995, *M. Zhurbenko 9515* (LE 233492) [with anamorph]; alt. 500 m, wet scree tundra, on *S. rivulorum*, 20.viii.1995, *M. Zhurbenko 9527* (M); on *S. depressum*, *M. Zhurbenko 95432* (LE 233644); S of Levinson-Lessinga Lake, 74°24'N, 98°46'E, alt. 50 m, pebble along lake bank, on *S. depressum*, 31.vii.1995, *M. Zhurbenko 95429* (LE 233505); junction of Khatanga and Oboinaya Rivers, 72°29'N, 104°14'E, forest-tundra, on *S. glareosum*, 3.viii.1996, *I. Kirtsideli* (LE 207642). **Altai Mts.:** Kurai Range at the boundary with Chuiskaya steppe, ca. 50°05'N, 88°50'E, alt. 3000 m, mountain tundra, on *S. rivulorum*, 14.vii.1903, *P. Krylov* (LE 233584). **Eastern Sayan Mts.:** Kryzhina Range, headwaters of Belyi Kitat River, 53°59'N, 95°32'E, alt. 1500 m, carbonate rocks in mountain tundra, on *S. myriocarpum*, 22.vii.2009, *M. Zhurbenko 0934* (LE 260211); 3 km N of Oka Lake, 51°55'N, 100°40'E, alt. 2000 m, shrub tundra, on *S. condensatum*, 15.vi.2005, *M. Zhurbenko 05189* (LE 233789) [with anamorph]. **Baikal Siberia:** Khamar-Daban Range, lower Khara-Murin River, ca. 51°25'N, 104°23'E, stones near water, on *S. glareosum*, 13.viii.1997, *I. Urbanavichene* (LE 207691); same range, Osinovka Mt., 51°30'N, 105°23'E, alt. 1500 m, by a stream in subalpine belt, on *S. condensatum*, 20.vii.1993, *M. Zhurbenko 9310* (LE 233564); same range, Sokhor Mt., headwaters of Ulan-Bai River, ca. 51°15'N, 105°15'E, subalpine belt, on *S. glareosum*, 27.vii.1997, *I. Urbanavichene* (LE 207700) [with anamorph]. **Mainland Yakutiya:** lower Lena River, Kharaulakh Range, Yuryung-Kysam Urochishche opposite Tit-Ary Is., 71°59'N, 126°19'E, alt. 150 m, rocks in tundra, on *S. depressum*, 19.viii.1998, *M. Zhurbenko 9823* (LE 233604); Laptevykh Sea coast, 3 km NW of Tiksi, 71°39'N, 128°45'E, alt. 70 m, dwarf shrub tundra, on *S. alpinum*, 24.viii.1998, *M. Zhurbenko 9826* (LE 233534); on *S. rivulorum*, 24.viii.1998, *M. Zhurbenko 9825* (LE 233514); middle Indigirka River, 8 km SW of Ust-Nera, 64°31'N, 143°08'E, alt. 700 m, stone field in *Larix* forest, on *S. glareosum*, 23.vii.1992, *M. Zhurbenko 92502* (LE 207711); alt.

1000 m, stone field in subalpine belt, on *S. glareosum*, 23.vii.1992, *M. Zhurbenko 92510* (LE 233694); on *S.* cf. *rivulorum*, 23.vii.1992, *M. Zhurbenko 92503* (LE 207721); on *S. intermedium*, 23.vii.1992, *M. Zhurbenko 92513:b* (LE 207724:b); same river, Predporozhnyi, 65°03'N, 143°09'E, alt. 450 m, stone field in *Larix* forest, on *S. condensatum*, 15.vii.1992, *M. Zhurbenko 92508:b* (LE 207727:b); same river, Momskie Rapids, 65°42'N, 142°39'E, alt. 300 m, stone field in *Larix* forest, on *S. intermedium*, 19.vii.1992, *M. Zhurbenko 92512* (LE 207728); same river, 54 km N-NNW of Ust'-Nera, 65°03'N, 143°09'E, alt. 450 m, stone field in *Larix* forest, on *S. glareosum*, 15.vii.1992, *M. Zhurbenko 92509* (LE 233664). **New Siberian Islands:** Bennetta Is. [all in stony arctic desert], Zeberga Glacier, ca. 76°40'N, 149°00'E, alt. 160 m, on *S. groenlandicum*, 18.vii.1989, *M. Zhurbenko 8975* (LE 207683); on *S. groenlandicum*, 9.viii. 1989, *M. Zhurbenko 8993* (LE 233502) [with anamorph]; Chernysheva Pen., alt. 70 m, on *S. rivulorum*, 4.viii.1989, *M. Zhurbenko 8983:b* (LE 207678:b). **Wrangel' Is.:** Rogers Bay, 71°00'N, 178°20'W, wet tundra, on *S. rivulorum*, 31.viii.1938, *B. Gorodkov* (LE 233414). **Chukotka:** Anyui Upland, middle Kytep-Guiten'ryveem River, Baranii Stream, on *S. glareosum*, 18.viii.1977, *V. Petrovskii* (LE 233482) [with anamorph].

18. **Protothelenella sphinctrinoidella* (Nyl.) H. Mayrhofer & Poelt

Notes. – Thallus of thin green algal film. Perithecia almost completely immersed to ½ protruding from host phyllocladia. Ascospores narrowly elliptic, with 3–9 transverse or oblique septa and usually 1(–2) longisepta in central segments, (23–)25–30(–32) × (8–)8.5–10.5(–14) µm, l/b = (2.1–)2.5–3.3(–3.6) (n = 43), 4(–8) per ascus.

This poorly and optionally lichenized fungus grows on soil, mosses, plant remnants and other lichens, such as *Cladonia* and *Peltigera* spp. (Mayrhofer 1987, Hafellner & Türk 2001, Zhurbenko & Alstrup 2004). It has not previously been reported on *Stereocaulon*, where it seems to be very rare.

Specimen Examined. – **RUSSIA. Karelia:** Kandalakshskii Gulf of White Sea, Keret' Is., 66°19'N, 33°42'E, alt. 40 m, rocks, on *Stereocaulon saxatile* (phyllocladia near bases of stems), 9.vii.1998, *D. Himelbrant* (LE 210402:a).

19. pyrenomycete 1

Short Description. – *Ascomata* perithecial, sessile, subglobose, 50–130 µm diam., black, glossy, without hairs. *Interascal filaments* persistent, filiform, septate, scarcely branched, 1–2 µm diam., not swollen at the apices. *Asci* unitunicate, discharging by longitudinal splits, subcylindrical 30–64 × 6–13 µm, (4–)8-spored, wall I+ and K/I + evenly blue. *Ascospores* hyaline, mostly soleiform with rounded apices, (0–)1-septate, not constricted at the septum, (8–)9.5–12.5(–15) × (3.5–)4–5(–7) µm, l/b = (1.1–)2.1–3.1(–3.9) (n = 75), smooth-walled, without halo, often with big guttules, mostly biseriate in the asci. Found on phyllocladia and stems of *Stereocaulon myriocarpum* and *S. paschale*. Infected parts are slightly discoloured.

Specimens Examined. – **RUSSIA. Altai Mts.:** 10 km W of Chernyi Anui, Shinok River valley, 51°22'N, 84°37'E, alt. 1200 m, humid mixed forest, on *S. paschale*, 22.vii.1996, *T. Lunke* (LE 207731). **Eastern Sayan Mts.:** Kryzhina Range, headwaters of Belyi Kitat River, 53°59'N, 95°32'E, alt. 1500 m, mountain tundra among carbonate outcrops, on *S. myriocarpum*, 22 VII 2009, M. Zhurbenko 0932 (LE 260271).

20. pyrenomycete 2

Short Description. – *Ascomata* perithecial, semiimmersed to sessile, subglobose, 100–200 µm diam, with wide pore, cinnamon to orange brown, without hairs. Peridium yellowish brown. *Interascal filaments* persistent, filiform, scarcely septate, not or rarely branched above, 1–1.5 µm diam., apically slightly swollen. *Asci* bitunicate, subcylindrical, 80–85 × 7–8 µm, 8-spored. *Ascospores* hyaline, narrowly elliptic, symmetric, with acute apices, 3-septate, (13–)14–19.5(–21) x (4–)4.5–5.5(–6) µm, l/b = 2.9–3.9(–4.2) (n = 11), overlapping uni- or biseriate in the ascus. Found on tomentose stems, occasionally phyllocladia of *Stereocaulon glareosum* and *S. rivulorum*. Pathogenicity not observed.

Specimens Examined. – **RUSSIA. Taimyr Pen.:** Dikson Is., 73°30'N, 80°20'E, alt. 30 m, stony tundra, on *S. rivulorum*, 7.vii.1990, *M. Zhurbenko 90903:a* (LE 233719:a). **Baikal Siberia:** 2 km SE of Anchuk, Bol'shaya Bystraya River, 51°44'N, 103°29'E, alt. 700 m, pebble among shrubs by the river bank, on *S. glareosum*, 9.vi.2005, *M. Zhurbenko 0554* (LE 233719).

21. *Rhymbocarpus stereocaulorum* (Alstrup & D. Hawksw.) Etayo & Diederich

Notes. – Ascomata apothecial, usually crowded up to 100 on gall-like swellings of the host thalli, at first immersed or at thallus level, then raised to sessile, concave or flat with slightly elevated margins, not constricted at the base, black, glossy, 0.1–0.2(–0.3) mm diam. Galls developed mostly on host stems, occasionally also on phyllocladia, at first concolorous with thallus, later reddish brown, 1–3.5 mm diam. Asci unitunicate, narrowly clavate, (29–)36–43–50(–55) × (7–)8–10–12(–14) (n = 39), 8-spored. Ascospores hyaline, simple, narrowly elliptic to very narrowly elliptic or lorate, straight or slightly curved, (12–)15–17.5–20.5(–25) × (2–)2.5–3–3.5(–4) µm, l/b = (3.5–)4.9–6.0–7.1(–9.5) (n = 113), biseriate to inclined uniseriate in the asci.

Found on the stems and occasionally phyllocladia of *Stereocaulon alpinum, S.* cf. *depressum, S. glareosum, S. groenlandicum, S. incrustatum* and *S. rivulorum*, on which it usually induces galls. Otherwise pathogenicity was not observed. *Stereocaulon glareosum* and *S. incrustatum* are new host species. All finds but one (in the mountain forest belt close to the upper tree limit) are from the Arctic, including a number form arctic deserts. New to North America (except Greenland) and mainland Chukotka.

Specimens Examined. – **U.S.A. Alaska:** Barrow, 71°18'N, 156°45'W, tundra, on *S. alpinum*, 1.viii.1998, *O. Sumina* (LE 233625). **RUSSIA. Severnaya Zemlya** [all in arctic desert]**:** Bol'shevik Is., Akhmatova Bay coast, 5 km SSW of Bazovaya River mouth, 79°04'N, 102°45'E, alt. 20 m, on *S. rivulorum*, 17.vii.1996, *M. Zhurbenko 96635* (LE 232177); Cape Antseva, 78°12'N, 103°17'E, alt. 30 m, on *S. rivulorum*, 6.viii.1997, *N. Matveeva* (LE 207650). **Taimyr Pen.:** Eniseyskii Gulf coast, Ragozinka River mouth, 72°48'N, 80°53'E, alt. 10 m, dwarf shrub tundra, on *S. rivulorum*, 11.vii.1990, *M. Zhurbenko 90372* (LE 207710); Uboinaya River mouth, 73°36'N, 82°22'E, alt. 10 m, dwarf shrub tundra, on *S. alpinum*, 9.viii.1990, *M. Zhurbenko 90364* (LE 207688); on *S. rivulorum*, 9.viii.1990, *M. Zhurbenko 90909:a* (LE 233900:a). **Mainland Yakutiya:** Lena River delta, Stolb Is., 72°24'N, 126°40'E, alt. 40 m, tundra, on *S. alpinum*, 12.viii.1998, *M. Zhurbenko 9811* (M); same delta, Novyi Chai-Tumus cabin, 72°20'N, 125°40'E, alt. 20 m, dwarf shrub tundra, on *S. depressum*, 6.viii.1998, *M. Zhurbenko 98240* (LE 260033); same delta, Bol'shaya Tumatskaya Channel, Amerika-Khaya hill, 72°35'N, 126°18'E, alt. 50 m, tundra, on *S. alpinum*, 30.vii.1998, *M. Zhurbenko 9817* (LE 233575); on *S. rivulorum*, *M. Zhurbenko 982* (LE 233615); Laptevykh Sea coast [all in scree dwarf shrub tundra], 3 km NW of Tiksi, 71°39'N, 128°45'E, alt. 70 m, on *S.* cf. *depressum*, 24.viii.1998, *M. Zhurbenko 98273* (LE 233585); 3 km SW of Tiksi, 71°40'N, 128°40'E, alt. 50 m, on *S. glareosum*, 17.vii.1998, *M. Zhurbenko 9849* (LE 233595); on *S. rivulorum*, 17.vii.1998, *M. Zhurbenko 9839* (LE 233605); middle Indigirka River, 8 km SW of Ust-Nera, 64°31'N, 143°08'E, alt. 700 m, stone field in sparse *Larix* forest, on *S. groenlandicum*, 23.vii.1992, *M. Zhurbenko 92504:b* (LE 207730:b). **New Siberian Islands:** Bennetta Is. [all in stony arctic desert], Andreevskaya River, ca. 76°40'N, 149°00'E, alt. 5 m, on *S. rivulorum*, 28.vii.1989, *M. Zhurbenko 8973* (LE 207686); alt. 30 m, on *S. rivulorum*, 16.viii.1989, *M. Zhurbenko 8977* (LE 207685); Chernysheva Pen., alt. 70 m, on *S. groenlandicum*, 4.viii. 1989, *M. Zhurbenko 8981* (LE 207664); on *S. rivulorum*, 4.viii.1989, *M. Zhurbenko 8983:a* (LE 207678:a). **Wrangel' Is.:** Neizvestnaya River, 71°13'N, 179°15'W, alt.190 m, *Dryas* tundra, on *S. alpinum*, 23.viii.1987, *S. Kholod* (LE 232128). **Chukotka:** Uelen, 66°20'N, 169°55'W, tundra, on *S. glareosum*, 11.viii.1938, *Trushkovskii* (LE 233545); on *S. incrustatum*, 11.viii.1938, *Trushkovskii* (LE 233555).

22. *Sphaerellothecium araneosum* (Arnold) Zopf s. l.

Notes. – This is a common fungus in the Arctic on *Ochrolechia* spp. but it also occurrs on some other lichen genera. It has been found on the phyllocladia of *Stereocaulon rivulorum* and *S. vesuvianum*. Pathogenicity not observed. New to Severnaya Zemlya.

Specimens Examined. – **RUSSIA. Severnaya Zemlya** [all in arctic desert]**:** Oktyabr'skoi Revolutsii Is., Cape Nekrasova, 80°02'N, 99°19'E, alt. 10 m, stone field, on *Stereocaulon vesuvianum*, 17.viii.2007, *M. Gavrilo* (LE 232128); Bolshevik Is., middle Golysheva River, 78°26'N, 104°28'E, alt. 170 m, on *S. rivulorum*, 6.viii.2000, *N. Matveeva* (LE 232170).

23. *Sphaerellothecium stereocaulorum* Zhurb. & Triebel

Notes. – Found on the naked stems of *Stereocaulon groenlandicum* and *S. rivulorum*. The latter is a new host species. This is the second record for Greenland (Alstrup et al. 2009). New to North America (except Greenland).

Specimens Examined. – **U.S.A. Alaska:** Denali National Park, headwaters of Hinnes Creek, 63°44'N, 149°07'W, alt. 1200 m, *Dryas* mountain tundra, on *S. groenlandicum*, 30.viii.2000, *M. Zhurbenko 00314:b* (LE

233665:b). **CANADA. Canadian Arctic Archipelago:** Axel Heiberg Is., Bunde Fjord, 80°30'N, 94°35'W, scree *Dryas* vegetation, on *S. rivulorum*, 1.viii.1999, *N. Matveeva* (LE 233424:a). **GREENLAND:** Mellem Land, 1 km NE of Narsarsuaq, Signalhojen Mt., 61°10'N, 45°24'W, alt. 60 m, scree roadside among shrub tundra, on *S. groenlandicum*, 22.vii.2005, *M. Zhurbenko 05293* (LE 233949).

24. *Stigmidium beringicum* Zhurb. & Triebel

Notes. – Found growing commensalistically on the phyllocladia and occasionally on stems of *Stereocaulon alpinum* and *S. tomentosum*. The latter is a new host species.

Specimens Examined. – **U.S.A. Alaska:** Wrangell-Saint Elias Park and Preserve, Nizina River, 61°22'N, 142°46'W, alt. 420 m, on *S. tomentosum*, 18.vii.2004, *J. Roth* (LE 233849:a). **RUSSIA. Kamchatka Pen.:** headwaters of Geisernaya River, foot of Kikhpinych Volcano, 54°26'N, 160°08'E, on *S. alpinum*, ix.1909, *V. Savicz* (LE 233622).

25. *Taeniolella christiansenii* Alstrup & D. Hawksw.

Notes. – The type of the species was described as growing on apothecia of the lichenicolous species *Arthonia stereocaulina* and spreading to adjacent phyllocladia of its host *Stereocaulon alpinum* (Alstrup & Hawksworth 1990). However, it seems to be a true stereocaulicolous species. It may be that, in the type collection, it was originally lichenicolous on *Stereocaulon* and subsueqently spread to the *Arthonia*. In the examined collections it has been found usually on the phyllocladia, occasionally also on the stems or soralia of *S. alpestre, S. alpinum, S. botryosum, S. depressum, S. glareosum, S. groenlandicum, S. intermedium, S. rivulorum* and *S. symphycheilum*. It is probably a moderate pathogen, since infected host tissues become dark. *Stereocaulon alpestre, S. botryosum, S. glareosum, S. intermedium, S. rivulorum* and *S. symphycheilum* are new host species. New to the U.S.A., British Columbia, Severnaya Zemlya, Taimyr Pen., Putorana Plateau, mainland Yakutiya, New Siberian Islands and Wrangel' Is.

Specimens Examined. – **U.S.A. Alaska:** Seward Pen., 7 km NE of Nome, Newton Peak, 64°33'N, 165°21'W, alt. 220 m, dwarf shrub tundra, on *S. glareosum*, 4.ix.2001, *M. Zhurbenko 0156* (LE 233442). **CANADA. Canadian Arctic Archipelago:** Axel Heiberg Is., Bunde Fjord, 80°30'N, 94°35'W, scree *Dryas* vegetation, on *S. rivulorum*, 1.viii.1999, *N. Matveeva* (LE 233424:b); Ellesmere Is., Eureka, 80°06'N, 85°34'W, alt. 180 m, scree *Dryas* vegetation, on *S. depressum*, 30.vii.1999, *F. Daniels* (LE 210322:c). **British Columbia:** Selkirk Mts., Columbia River Valley, N of Revelstoke, Downie Creek mouth, alt. 650 m, open boulder field, on *S. intermedium*, 20.vii.2002, *M. Zhurbenko 02138:a* (LE 233839:a). **GREENLAND:** Mellem Land, 1 km NE of Narsarsuaq, Signalhojen Mt., 61°10'N, 45°24'W, alt. 60 m, scree roadside among shrub tundra, on *S. alpestre*, 22.vii.2005, *M. Zhurbenko 05294* (LE 233919). **RUSSIA. Severnaya Zemlya** [all in arctic desert]**:** Oktyabr'skoi Revolutsii Is., Cape Massivnyi, 78°49'N, 99°29'E, alt. 10 m, stone field, on *S. groenlandicum*, 16.viii.2007, *M. Gavrilo* (LE 210370); Bol'shevik Is., Ostantsovaya River, 79°13'N, 102°02'E, alt. 40 m, on *S. glareosum*, 12.vii.1996, *M. Zhurbenko 96947:b* (LE 233407:b); Cape Antseva, 78°12'N, 103°17'E, alt. 30 m, on *S. alpinum*, 19.vii.2000, *N. Matveeva* (LE 233486). **Taimyr Pen.:** Dikson Is., 73°30'N, 80°20'E, alt. 30 m, tundra, on *S. alpinum*, 7.vii.1990, *M. Zhurbenko 901151* (LE 233749); Eniseyskii Gulf coast, Ragozinka River mouth, 72°48'N, 80°53'E, alt. 40 m, stony dwarf shrub tundra, on *S. groenlandicum*, 2.vii.1990, *M. Zhurbenko 90835* (LE 233870); same coast, Osipovka River, 72°42'N, 80°51'E, alt. 50 m, dwarf shrub tundra, on *S. alpinum*, 18.vii.1990, *M. Zhurbenko 90370:a* (LE 207693:a); lower Pravaya Uboinaya River, "217" Mt., 73°26'N, 82°43'E, alt. 150 m, dwarf shrub tundra, on *S. alpinum*, 5.viii.1990, *M. Zhurbenko 90896* (LE 233950); Byrranga Mts., S of Levinson-Lessinga Lake, 74°24'N, 98°46'E, alt. 120 m, rocks along Protochnyi Stream, on *S. symphycheilum*, 28.viii.1995, *M. Zhurbenko 95438* (LE 233682); middle Bol'shaya Bootankaga River, 74°30'N, 97°45'E, alt. 370 m, rocks in tundra, on *S. botryosum*, 16.viii.1995, *M. Zhurbenko 95436* (LE 233521); on *S. groenlandicum*, 16.viii.1995, *M. Zhurbenko 95437* (LE 233531). **Putorana Plateau:** S of Ayan Lake, 69°00'N, 94°15'E, alt. 1100 m, stony mountain tundra, on *S. depressum*, 16.viii.1984, *M. Zhurbenko 84313* (LE 233692). **Mainland Yakutiya:** Laptevykh Sea coast [all in scree dwarf shrub tundra], 3 km NW of Tiksi, 71°39'N, 128°45'E, alt. 70 m, on *S. depressum*, 24.viii. 1998, *M. Zhurbenko 98322:a* (LE 233452:a); on *S. groenlandicum*, 24.viii.1998, *M. Zhurbenko 9828* (LE 233551); 3 km SW of Tiksi, 71°40'N, 128°40'E, alt. 50 m, on *S. groenlandicum*, 17.vii.1998, *M. Zhurbenko 9846:a* (LE 233541:a). **New Siberian Islands:** Bennetta Is., Zeberga Glacier, ca. 76°40'N, 149°00'E, alt. 140 m, stony arctic desert, on *S. groenlandicum*, 9.viii.1989, *M. Zhurbenko 8972* (LE 207677). **Wrangel' Is.:** Gusinaya River, ca. 71°11'N, 179°09'E, alt. 475 m, stony tundra, on *S. rivulorum*, 24.vii.1991, *S. Kholod* (LE 233402).

Results and Discussion

This catalogue includes 22 species of lichenicolous fungi and three lichens found on *Stereocaulon* species. *Lichenopeltella stereocaulorum*, *Lichenosticta dombrovskae* and *Odontotrema stereocaulicola* are described as new to science and brief characteristics of two further possibly undescribed species found on *Stereocaulon* are presented.

A number of finds are biogeographic novelties: *Arthonia stereocaulina, Opegrapha stereocaulicola, Rhymbocarpus stereocaulorum* and *Sphaerellothecium stereocaulorum* are new to North America (except Greenland); *Endococcus nanellus* is new to Kazakhstan, Alaska and Greenland; *Arthonia stereocaulina* and *Opegrapha stereocaulicola* are new to Svalbard; *Catillaria stereocaulorum, Cercidospora stereocaulorum, Lasiosphaeriopsis stereocaulicola, Polycoccum trypethelioides* and *Taeniolella christiansenii* are new to the U.S.A.; *Catillaria stereocaulorum* and *Niesslia peltigericola* are new to the Canadian Arctic Archipelago; *Lasiosphaeriopsis stereocaulicola* and *Taeniolella christiansenii* are new to British Columbia; and *Catillaria stereocaulorum* is new to Mongolia. Extensive data on distribution and host spectra of stereocaulicolous fungi in the Russian Arctic were published in Karatygin et al. (1999). However, many of the reported species are still new to various regions of Russia.

The lichenicolous fungi *Endococcus rugulosus*, *Niesslia peltigericola* and *Phaeosporobolus alpinus* and lichens *Anzina carneonivea* and *Protothelenella sphinctrinoidella* are documented for the first time on *Stereocaulon*. *Stereocaulon alpestre, S. alpinum, S. arcticum, S. botryosum, S. depressum, S. glareosum, S. groenlandicum, S. grande, S. incrustatum, S. intermedium, S. myriocarpum, S. paschale, S. rivulorum, S. saxatile*, *S. subcoralloides, S. symphycheilum* and *S. tomentosum* are new host species for various lichenicolous fungi.

No species of the examined lichenicolous fungi represented by multiple collections was restricted to a separate organ/part of the host, though most exhibited preferences for a particular location. Eight species were mainly found on phyllocladia and another eight on stems. Five species were occasionally found on cephalodia, two on apothecia and two on soralia.

Most of the 22 species of lichenicolous fungi studied should be classified as commensals. Mild pathogenicity was clearly demonstrated only by *Taeniolella christiansenii* and possibly *Sphaerellothecium stereocaulorum*. However, two fungal species usually induce conspicuous galls and another three occasionally cause local swellings of host tissues.

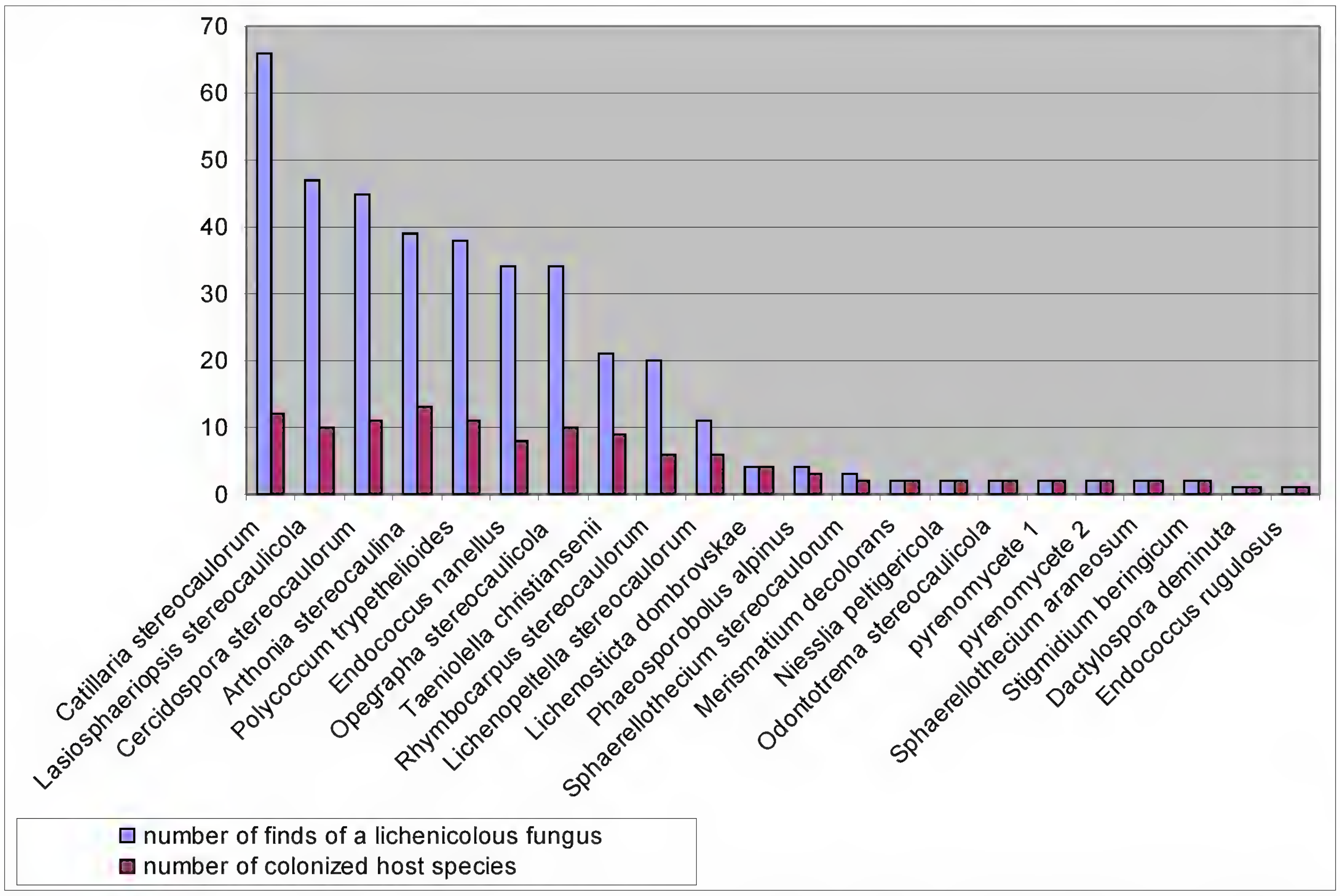

Plate 7. Frequency of lichenicolous fungi (based on total number of finds) compared to the number of host species known to be infected by each taxon.

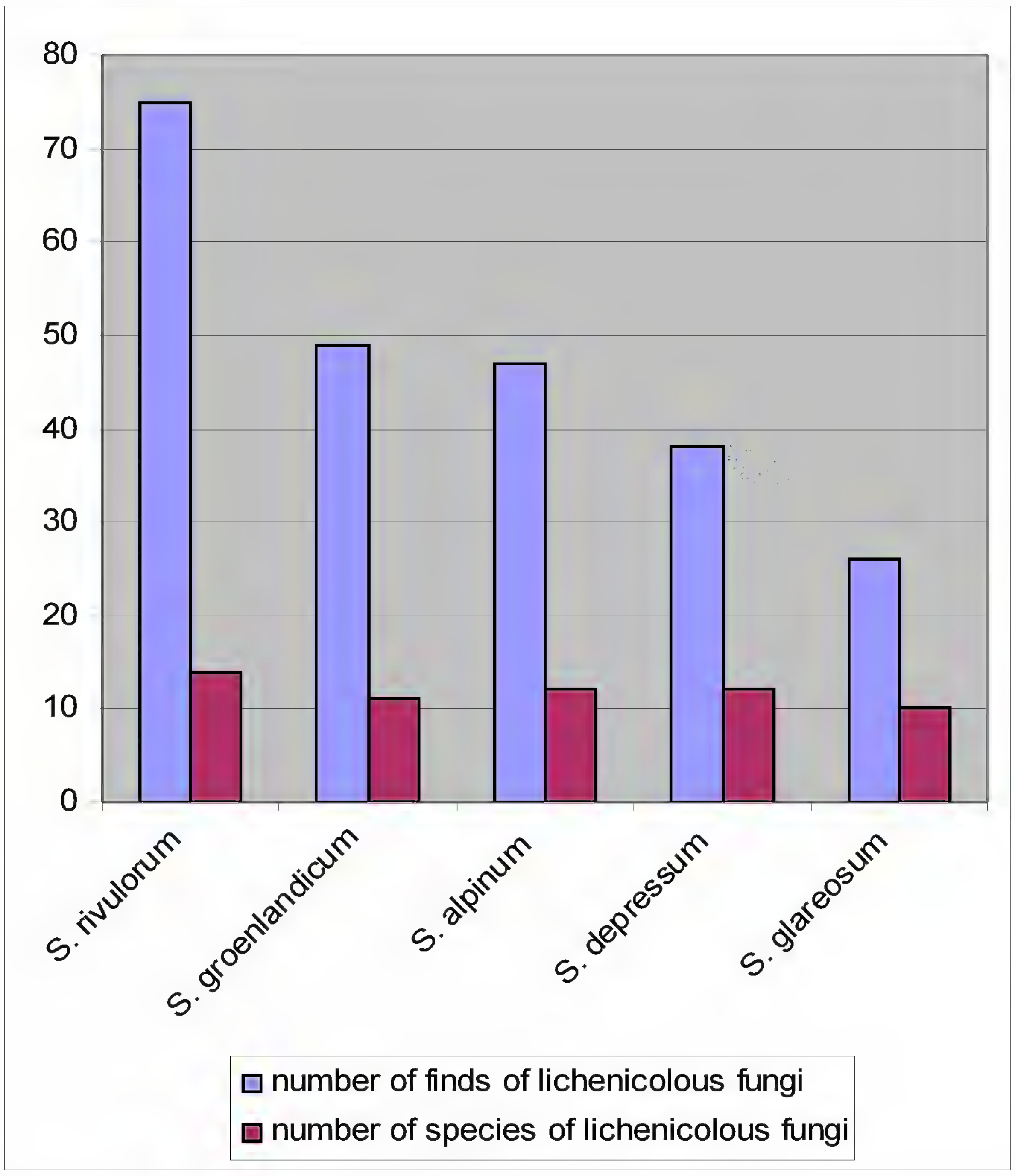

Plate 8. Comparison of the five *Stereocaulon* species most infected by lichenicolous fungi.

The following ten of the 22 species of lichenicolous fungi are represented by ten or more specimens examined (Plate 7): *Catillaria stereocaulorum* (66 finds/on 12 host species), *Lasiosphaeriopsis stereocaulicola* (47/10), *Cercidospora stereocaulorum* (45/11), *Arthonia stereocaulina* (39/13), *Polycoccum trypethelioides* (38/11), *Endococcus nanellus* (34/8), *Opegrapha stereocaulicola* (34/10), *Taeniolella christiansenii* (21/9), *Rhymbocarpus stereocaulorum* (20/6) and *Lichenopeltella stereocaulorum* (11/6). All these frequent species are confined (or almost so) to *Stereocaulon*.

Considering the better collected hosts, *viz*. the dominant arctic *Stereocaulon* species growing on soil, it is possible to estimate frequency of their colonization by lichenicolous fungi. Plate 8 shows the five most frequently colonized arctic terricolous host species. It is noteworthy that *Stereocaulon alpinum*, the most common terricolous species of the genus in the Arctic, is much more rarely colonized than *S. rivulorum* (another common species) and even *S. groenlandicum* (a sporadic species). Occurrence of lichenicolous fungi on *S. depressum* and *S. glareosum* is high, given their frequency. It can be hypothesized that this discrepancy is due to the much more robust thallus construction of *S. rivulorum, S. groenlandicum*, *S. depressum* and *S. glareosum*, which favors their colonization, compared to rather lax thallus of *S. alpinum*. However, there are no significant differences in number of fungal species on all these hosts.

In total, 30 species of lichenicolous fungi, one non-lichenicolous fungus and eight lichen species have been reported on *Stereocaulon* (see key below). Of these, 18 species of lichenicolous fungi are restricted to this host genus. Another two species are almost confined to *Stereocaulon*: *Arthonia stereocaulina* has also been recorded on *Leprocaulon* and *Taeniolella christiansenii* on *Arthonia stereocaulina*, growing on *Stereocaulon* (Alstrup & Hawksworth 1990). It is noteworthy that among the remaining ten species of lichenicolous fungi occasionally found on *Sterocaulon*, none is specific to Stereocaulaceae in the modern sense, which includes *Hertelidea*, *Lepraria*, *Stereocaulon*, *Squamarina* and *Xyleborus* (Lumbsch & Huhndorf 2007). In this family, associated fungi are also known from *Lepraria* (harbouring 20 species, including 5 species restricted to that genus) and *Squamarina* (11 and 7 species respectively). *Stereocaulon* shares with *Lepraria* and *Squamarina* just 4 species, viz. *Merismatium decolorans*, *Phaeosporobolus alpinus, Intralichen christiansenii* and *Sphaerellothecium araneosum* (Alstrup 2004, Etayo & Breuss 1996, Suija 2005b, Suija et al. 2008). These are all common fungi with rather wide spectra of hosts, apparently only occasionally growing on these hosts.

As most species of lichenicolous fungi are believed to be specific to a single host genus they can be used for testing taxonomic hypotheses concerning generic delimitation (Hafellner 1990, Lawrey & Diederich 2003). *Endococcus rugulosus* s. l., is the second lichenicolous fungus found on crustose species of *Stereocaulon*, but is unknown on the fruticose species. The other lichenicolous fungus known from a crustose species of *Stereocaulon* is *Cercidospora alpina*, which is known only from *S. cumulatum* (Ihlen & Wedin 2007). Recent studies of the molecular phylogeny of the genus *Stereocaulon* supported inclusion of the crustose species in the genus (Högnabba 2006). However, the assemblage of lichenicolous fungi presently known from fruticose and crustose species of *Stereocaulon* does not support their close relationship.

KEY TO THE LICHENICOLOUS FUNGI AND LICHENS GROWING ON STEREOCAULON SPECIES

The key is based on data in Alstrup & Hawksworth (1990), Etayo (2002), Etayo & Sancho (2008), Hansen et al. (1987), Hawksworth (1979), Ihlen & Wedin (2007), Santesson et al. (2004), Thomson (1997), Thorn et al. (1998), Triebel (1989), Zhurbenko (2009b), Zhurbenko & Matveeva (2006), Zhurbenko & Triebel (2008), Zhurbenko et al. (2009) and the present publication. Along with the proper lichenicolous fungi, eight lichens and one basidiomycete species, occurring on *Stereocaulon* as well as on various soil substrates and/or thalli of other lichens, are also included. "*Vouauxiomyces* spec. 4" with conidia 6–9 × 3.5–4 µm growing on *Stereocaulon azoricum* in the Azores (Berger & Priemetzhofer 2008) and non-lichenicolous *Ceriporiopsis mucida* (Pers.:Fr.) Gilbn. & Ryv. occasionally growing on *Stereocaulon* (Thorn et al. 1998) are not included in the key. Species of lichenicolous fungi specific to *Stereocaulon* are given in bold.

1a. Anamorphic fungus 2
  2a. Hyphomycete 3
    3a. Colonies mainly superficial, appearing as dark brown bristles; conidia 0–1-septate, verrucose-striate ....*Taeniolella christiansenii* Alstrup & D. Hawksw.
    3b. Colonies mainly immersed in host tissues, conidia smooth-walled 4
      4a. Conidia 1-septate, 5–8(–9) × 4–6 µm, pale brown; infections may look like brownish soralia ....*Intralichen christiansenii* (D. Hawksw.) D. Hawksw. & M. Cole
      4b. Conidia 2- to multiseptate to muriform, dark brown, mainly 18–25 × 6–12 µm ....*Intralichen lichenicola* (M. S. Christ. & D. Hawksw.) D. Hawksw. & M.S. Cole
  2b. Coelomycete 5
    5a. Conidia brown, 10–20-celled, irregularly subglobose, 9–17 µm diam.; conidiomata superficial, black, stromatic, subglobose, 20–75 µm diam. ....*Phaeosporobolus alpinus* R. Sant., Alstrup & D. Hawksw.
    5b. Conidia hyaline, simple 6
      6a. Conidiomata immersed, flask-shaped; conidia bacilliform, 5–8 × 1–2 µm .... anamorph of ***Opegrapha stereocaulicola* Alstrup & D. Hawksw.**
      6b. Conidiomata immersed to erumpent, cupuliform or subglobose; conidia different 7
        7a. Conidia (4.5–)6.5–8.5(–11) × (3–)4–4.5(–5.5) µm, elliptic, usually attenuated and truncated at the base .... ***Lichenosticta dombrovskae* Zhurb.**
        7b. Conidia (3.5–)4–5(–7) × 1.5–2 µm, (narrowly) oblong to elliptic, truncated at the base .... anamorph of ***Polycoccum trypethelioides* (Th. Fr.) R. Sant.**
        7c. Conidia (8–)10–12.5(–13.5) × 1–1.5 µm, falcate to bacilliform .... anamorph of ***Catillaria stereocaulorum* (Th. Fr.) H. Olivier**

1b. Teleomorphic fungus 8

8a. Basidiomycete; basidiomata membranous yellow-orange; sclerotia yellow-orange, 1–5 mm across; growing on litter and below or between mats of terricolous species of *Cladonia* and *Stereocaulon* . ... *Leucogyrophana lichenicola* Thorn, Malloch & Ginns

8b. Ascomycete 9

9a. Ascomata catathecial, cone-shaped, 50–100 µm diam., ostiole without setae; ascospores hyaline, soleiform, without setulae, (11–)13–16.5(–18) × 4–5(–6) µm, 8 per ascus .... ***Lichenopeltella stereocaulorum* Zhurb.**

9b. Ascomata not catathecial 10

10a. Ascomata perithecial 11

11a. Ascomata sitting on cottony white subiculum, orange-pink, 0.5–0.7 mm diam.; ascospores elliptic, bicaudate, muriform, hyaline to pale salmon to yellow brown, 41–72 × 21–31 µm; as yet known only from Papua New Guinea (at elev. 4200 m) .... *Paranectria* cf. *alstrupii* Zhurb.

11b. Ascomata not sitting on cottony white subiculum; ascospores smaller 12

12a. Ascomata with setae or hairs 13

13a. Ascomata with straight setae 37–50 × 3–5 µm, subglobose, 75–100 µm diam.; asci bitunicate, 8-spored; ascospores hyaline to pale clay buff, (0–)1-septate, (12–)13.5–16.5(–20) × (4–)5–6.5(–8) µm ....*Niesslia peltigericola* (D. Hawksw.) Etayo

13b. Ascomata often with dark, straight, unbranched hairs, mostly pyriform to ovate, rough, 0.2–0.4 mm diam.; asci unitunicate, 4-spored; ascospores hyaline then brown, aseptate, (14–)20–26.5(–35) × (10–)11.5–14.5(–18.5) µm ....***Roselliniella stereocaulorum* Zhurb., Kukwa & Oset**

12b. Ascomata without setae or hairs 14

14a. Ascospores hyaline or pale coloured 15

15a. Ascospores submuriform...16

16a. Ascospores pale to dark brown, 15–25 × 6–8.5 µm, 8 per ascus, not lichenized ..*Merismatium* aff. *nigritellum* (Nyl.) Vouaux

16b. Ascospores hyaline, (23–)25–30(–32) × (8–)8.5–10.5(–14) µm, 4(–8) per ascus; weakly lichenized.................................. ......*Protothelenella sphinctrinoidella* (Nyl.) H. Mayrhofer & Poelt

15b. Ascospores not submuriform 17

17a. Ascospores pluriseptate...18

18a. Interascal filaments absent, ascospores (1–)3(–4)-septate, hyaline to pale grey, elliptic to narrowly elliptic, (10–)12.5–15.5(–18) × (4–)5–5.5(–6) µm; ascomata (100–)125–150(–250) µm.. ....*Merismatium decolorans* (Arnold) Triebel

18b. Interascal filaments persistent 19

19a. Ascomata cinnamon to orange brown, interascal filaments mostly unbranched; ascospores 3-septate, narrowly elliptic, with acute apices, (13–)14–19.5(–21) x (4–)4.5–5.5(–6) µm .... **pyrenomycete 2**

19b. Ascomata black, interascal filaments branched 20

20a. Ascomata 0.2–0.35 mm diam., asci 8-spored, ascospores, 3–4(–7)-transseptate, (18–)19.5–33(–43) × (4–)4.5–6.5(–7) µm, with perispore, as yet known only on crustose terricolous *Stereocaulon cumulatum* ……..…………………… …………..***Cercidospora alpina* Ihlen & Wedin**

20b. Ascomata 0.1–0.2(–0.3) mm diam., asci (2–)4(–8)-spored, ascospores, (1–)3(–6)-transseptate, (13–)18.5–25.5(–30) × (4–)5–7(–8) µm, without distinct perispore ……..……………….…....... …***Cercidospora stereocaulorum* (Arnold) Hafellner**

17b. Ascospores always or mostly 1-septate 21

21a. Interascal filaments persistent, filiform, septate, scarcely branched; asci unitunicate, (4–)8-spored, wall I+ blue, K/I + blue; ascospores mostly soleiform, (8–)9.5–12.5(–15) × (3.5–)4–5(–7) µm, hyaline, (0–)1-septate …...................... ……………………….......................... **pyrenomycete 1**

21b. Interascal filaments absent; asci bitunicate, 8-spored ……….. 22

22a. Vegetative hyphae inconspicuous; ascospores soleiform or fusiform 23

23a. Hymenial gel I– or I+ vanishing red-purple; ascus wall K/I+ blue; ascospores hyaline then pale grey-olive, (0–)1-septate, (6–)9–12(–15) × (2–)3–4(–5) µm, narrowly soleiform to fusiform, often tapering towards apices ………………… …………………..***Endococcus nanellus* Ohlert**

23b. Hymenial gel I–, ascus wall K/I–; ascospores hyaline, 1-septate ……………………………24

24a. Ascomata 75–100(–150) µm diam., short pseudoparaphyses of type “b” present (see: Calatayud & Triebel 2003: 104); ascospores, (14–)16–19(–20) × (3.5–)4–5 µm, narrowly soleiform to fusiform, often tapering towards apices ....***Stigmidium beringicum* Zhurb. & Triebel**

24b. Ascomata 50–75(–100) µm diam., short pseudoparaphyses of type “b” absent; ascospores, (10–)12–15(–17) × (3–)4–4.5(–5.5) µm, soleiform ....***Stigmidium stereocaulorum* Zhurb. & Triebel**

22b. Vegetative hyphae conspicuous; ascospores soleiform 25

25a. Associated with epinecral layer of the host stems; ascospores (7.5–)8.5–11(–12.5) × (3–)3.5–4.5(–5) µm, hyaline or occasionally pale olive, 1(–3)-septate……………………..…. ….***Sphaerellothecium stereocaulorum* Zhurb. & Triebel**

25b. Not associated with epinecral layer of the host stems; ascospores (9–)10–13(–16) × 3–4.5(–6) µm, hyaline, 1 septate......................... …*Sphaerellothecium araneosum* (Arnold) Zopf s.l.

14b. Ascospores intensively coloured, at least at maturity 26

26a. Ascospores simple, brown, (14–)20–26.5(–35) × (10–)11.5–14.5(–18.5) µm .... ***Roselliniella stereocaulorum***

26b. Ascospores (0–)1-septate, olive or brown, mainly elliptic, with more or less equal cells, (7-)12.5-16(-18) × (3-)6.5-8.5(-10) µm, 8 per ascus; ascomata 0.15–0.25 mm diam.; does not induce galls, as yet known only on crustose saxicolous *Stereocaulon plicatile* .... *Endococcus rugulosus* Nyl. s.l.

26c. Ascospores (0–)1-septate, olive or brown, obpyriform to obovate, with markedly unequal cells, (12–)15–19(–22.5) × (7–)8.5–10.5(–12.5) µm, (4–)8 per ascus; ascomata 0.15–0.45 mm diam., aggregated on galls .... ***Polycoccum trypethelioides***

26d. Ascospores (2–)4–6(–9)-transseptate, occasionally with additional oblique septa, olivaceous or dark brown, elliptic to narrowly elliptic, (13–)28.5–40.5(–50) × (6.5–)9–12(–17) µm, (2–)4(–6?) per ascus; ascomata 0.2–0.3(–0.5) mm diam., rough .... ***Lasiosphaeriopsis stereocaulicola* (Linds.) O.E. Erikss. & R. Sant.**

26e. Ascospores submuriform (with 3–5 trans- and 0–2 longisepta), pale to dark brown, 15–25 × 6–8.5 µm, 8 per ascus, not lichenized .... *Merismatium* aff. *nigritellum*

10b. Ascomata apothecial 27

27a. Lichen, occasionally growing on *Stereocaulon* 28

28a. Ascomata immersed, urceolate; ascospores muriform, brown, 20–40 × 8–18 µm, 4 per ascus .... *Diploschistes muscorum* (Scop.) R. Sant.

28b. Ascomata sessile 29

29a. Thallus always well-developed; ascospores simple or muriform, hyaline to brownish 30

30a. Thallus white, verruculose, sometimes with spine-like extensions; ascomata discoid; ascospores simple, hyaline, 8 per ascus, 26–43 × 15–26 µm .... *Ochrolechia frigida* (Sw.) Lynge

30b. Thallus brown olive, coralloid; ascomata cup-shaped; ascospores muriform, hyaline to brownish, 1 per ascus, 70–115 × 20–47 µm ....*Lopadium coralloideum* (Nyl.) Lynge

29b. Thallus usually poorly developed; ascospores 1(–3)-septate, hyaline 31

31a. Ascomata K–; ascospores 1(–3)-septate, not polarilocular, 10–16 × 5–8 µm .... *Anzina carneonivea* (Anzi) Scheid.

31b. Ascomata K+ purple; ascospores 1-septate, polarilocular 32

32a. Ascospores 4 per ascus, 22–29 × 14–20 µm, septum 1–2 µm ....*Caloplaca tetraspora* (Nyl.) H. Olivier

32b. Ascospores 8 per ascus, 11–20 × 5–9 µm, septum 3.5–6.5 µm .... *Caloplaca ammiospila* (Ach.) H. Olivier

32c. Ascospores 8 per ascus, 10–13 × 5–8 µm, septum 2–3.5 µm .... *Caloplaca epithallina* Lynge

27b. Not lichenized lichenicolous fungus 33

33a. Ascomata lirelliform, elliptic or circular, 0.5–2 × 0.5–4 mm; ascospores elliptic, hyaline then brown, (0–)3–5(–6)-septate, (13.5–)19.5–26(–33) × (4–)5–7(–8.5) µm .... ***Opegrapha stereocaulicola***

33b. Ascomata never lirelliform, less than 1 mm across 34

34a. Ascomata immersed to superficial, with concave or occasionally flat disc; ascospores hyaline 35

35a. Ascospores acicular to fusiform with pointed ends, (0–)1(–3 ?)-septate, (22–)25.5–32.5(–38) × (2–)2.5–3(–3.5) µm …………………………. ……………………………………*Odontotrema stereocaulicola* **Zhurb.**

35b. Ascospores narrowly elliptic to very narrowly elliptic or lorate, aseptate, (12–)15–20.5(–25) × (2–)2.5–3.5(–4) µm ....***Rhymbocarpus stereocaulorum*** **(Alstrup & D. Hawksw.) Etayo & Diederich**

34b. Ascomata superficial, with convex or occasionally flat disc ……..………36

36a. Ascospores brown …………………………………..………...…… 37

37a. Ascomata discoid, 0.1–0.6 mm diam.; ascospores narrowly elliptic, 3–7-transseptate, wall smooth, (13–)16–22(–24) × 5–6.5(–7.5) µm ……..……........................*Dactylospora deminuta* (Th. Fr.) Triebel

37b. Ascomata subglobose, 0.1–0.2 mm diam.; ascospores soleiform, 1-septate, wall granulate, 6.5–8 × 3–3.5 µm; as yet known only from Columbia and Papua New Guinea at elevation about 3000 m ……….............***Abrothallus stereocaulorum*** **Etayo & Diederich**

36b. Ascospores hyaline ………………………………………………..….. 38

38a. Ascomata discoid to subglobose, sometimes marginate, brown then black, 0.1–0.8 mm diam.; paraphyses with dark brown apical caps; ascospores elliptic to narrowly elliptic/ oblong, (0–)1-septate, cells equal, (10.5–)13.5–17.5(–19) × (3.5–)4–5.5(–6.5) µm.................... ....………..…………................ ***Catillaria stereocaulorum***

38b. Ascomata irregularly convex, emarginate, black, 0.05–0.5 mm diam.; interascal filaments without dark apical caps; ascospores soleiform, 1-septate, upper cell broader, (10.5–)11.5–14(–17) × (4–)4.5–6(–7.5) µm……..*Arthonia stereocaulina* (Ohlert) R. Sant.

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A review of *Lecania croatica* (syn. *Catillaria croatica*) in North America

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ABSTRACT. – The status of *Lecania croatica* in North America is reviewed. Although originally reported only from Great Smoky Mountains National Park, the species is shown to be widespread and locally common throughout the Appalachian Mountains as well as Great Lakes Region and Ozark Ecoregion of eastern North America. Both American and European material of the species is illustrated for the first time and a map of the distribution in North America is provided.

INTRODUCTION

The last two decades have seen a remarkable increase in our knowledge of isidiate and sorediate crustose lichens both in North America and abroad. Indeed from our continent alone numerous species have been, and continue to be, newly described and reported (Fryday et al. 2007; Harris & Ladd 2008; Harris & Lendemer 2009; Kalb 2004, Lendemer 2007, 2009, 2009a; Lendemer et al. 2008; Lendemer & Harris 2007; Lendemer & Lumbsch 2008; Printzen & Tønsberg 2007, Tønsberg 2004, 2007; Wetmore 2004). Despite the amount of progress it is clear from our studies in the field and in the herbarium that there are still many unresolved problems. Among these is a puzzling corticolous sorediate taxon that lacks secondary chemistry and is common throughout eastern North America. The first author initially became aware of this species more than four decades ago while collecting in northern Michigan and included it as "*Lecidea* sp. 4" in his keys to the lichens of the Michigan Straits Region (Harris 1977). In the decades following this publication many additional specimens of the taxon accumulated, and when the second author began collecting in North America he also routinely encountered it. In light of copious material available to us, which included fertile specimens, we decided to finally pursue the identity of this taxon and describe it if it was new to science. While reviewing the literature for other sorediate crustose lichens without lichen substances we came upon the name *Lecania croatica* (Zahlbr.) Kotlov (syn. *Catillaria croatica* Zahlbr.). The species had been tentatively referred to *Cliostomum* Fr. by Printzen (1995) in the excludenda of his monograph of *Biatora* and had been casually reported from Great Smoky Mountains of eastern North America by Tønsberg (2004). Comparison of our material to a topotype of *C. croatica*, as well as to several North American specimens identified by Christian Printzen, convinced us that, at least until we have a better understanding of the European population, the name *Lecania croatica* can be applied to the American population. Since our material significantly extends the range of *L. croatica* in North America we have chosen to provide a review of the species and take the opportunity to provide a detailed description as well as the first color illustrations of both European and North American material.

MATERIALS AND METHODS

Specimens were studied with a Zeiss Stemi 200-C dissection microscope and images of the thallus and apothecia were captured using an Olympus DP20 digital camera using Microsuite Special Edition. Microscopic characters were measured in water with an Olympus BX51 microscope and images were

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captured in the same manner as above. The chemistry of representative specimens of all species was studied with Thin Layer Chromatography (TLC) using solvents A or C following standardized methods. A representative specimen of *Lecania croatica* was also examined with SEM to better characterize the ontogeny of the soralia. Samples were removed from a herbarium specimen with a razor blade and not subjected to fixation, rinsing, or dehydration. They were mounted on aluminum stubs using conductive carbon adhesive tabs and sputter coated for 2 minutes at 10 milliamps with gold. Following coating the samples were examined with a scanning electron microscope (Hitachi S-2700) with a tungsten filament operating with an accelerating voltage of 20 kv. Digital images were captured using Quartz PCR Image Management System.

THE SPECIES

***Lecania croatica* (Zahlbr.) Kotlov,** Nov. sist. Niz. Rast. 37:251. 2004.

Catillaria croatica Zahlbr., Ann. Mycol. 4: 487. 1906. TYPE: "Kroatien: An dem Wege von Jelenje [gornje] auf den Risnjak [?] in der Nähe [des Berges] Levurdica, [1000-1200 m], an Bergahorn, 1904, [J. Schuler]" (W, lectotype designated by Printzen, 1995).

DESCRIPTION (AMERICAN SPECIMENS). – **Thallus** superficial, ranging from well developed to poorly developed and even mostly immersed, light gray or tan, rarely dark green, areolate when well developed, 50-70 µm thick; areoles sometimes coalescing and ± continuous, sometimes reduced to small indistinct bumps or mostly immersed, when well developed with a poorly developed, patchy cortex, sorediate, with discrete rounded soralia; soralia flat, convex or weakly capitate, scattered to crowded, sometimes crowded and appearing patchily leprose, initially formed at margins of areoles (always?), 0.2-0.4 mm across; soredia pale green when fresh, slightly yellowish or rarely whitish in herbarium, globose, 12-15 µm across, aggregates to ca. 30 µm; photobiont green, globose, 6-10 µm across. **Apothecia** initially with pale brown or pale orangish disk and pallid margin, aging to medium brown disk with margin concolorous or slightly paler, often ± mottled, entirely dark brown in exposed situations (once almost black), sessile, weakly concave, flat or weakly convex, constricted at base, 0.2-0.4(-0.7) mm across, 0.15-0.25 µm high; margin level with disk, persistent or not visible in more swollen apothecia. **Exciple** usually patchily brown tinted, especially adjacent to hymenium, occasionally entirely brown, occasionally completely colorless, 60-80 µm thick, composed of thick-walled radiating hyphae. **Hypothecium** colorless or tinted pale brown, ca. 50-60 µm thick. **Epihymenium** colorless. **Hymenium** colorless above, tinted brown in lower part (once almost entirely brown), 70 µm high. **Paraphyses** more or less unbranched, ca. 2.2-2.4 µm across, slightly expanded at tips to 3-3.5(-5) µm. **Asci** *Bacidia* type with shallow axial body, with 8 irregularly arranged or ± biseriate spores. **Ascospores** variable, narrowly fusiform to fusiform, colorless, 0-1-[2]-septate, 12-15(-17) x 3-4(-4.5) µm. **Pycnidia** immersed, subglobose, brown at apex, colorless below, ca. 70-100 µm across. **Conidia** filiform, 13-19 x 1 µm.

CHEMISTRY. – No substances detected. Spot tests: K-, C-, KC-, P-, UV-. Brown apothecial pigment K-, N+ red purple, fading. Hymenium I+ mixture of blue green and dirty orangish, KI+ dark blue green. Hypothecium weakly I+ blue-green in upper part, patchily KI+ blue-green.

ECOLOGY AND DISTRIBUTION. – In North America *Lecania croatica* occurs on the bark of hardwoods primarily in high humidity. We examined only a single collection from a conifer (*Tsuga*). Occasionally the *Lecania* grows off bark onto bryophytes. The species is infrequent but often locally abundant and is widespread in the Appalachian Mountains with disjunct populations in the Great Lakes Region and Ozark Ecoregion. It only occasionally produces apothecia (10/50), often only sparingly, i.e., one or two per collection.

DISCUSSION. – We are adopting the name *Lecania croatica* for this taxon with a little hesitation for two reasons. First, we have examined only a single European specimen and there is only a single previous description available (the original protologue) although Hafellner et al. (2005) discuss the separation from *Mycobilimbia epixanthoides* (Nyl) Hafellner & Türk. Reports in the literature are few, Austria (Hafellner et al. 2005), Croatia (Zahlbruckner 1906), Romania (Ciurchea undated), Slovakia (Reese Naesborg et al. 2007), Slovenia (Mrak et al. 2004). American material agrees with Zahlbruckner's in appearance of the soralia (yellowish in herbarium, "lutescentibus" according to Zahlbruckner, 1906), structure of exciple, and

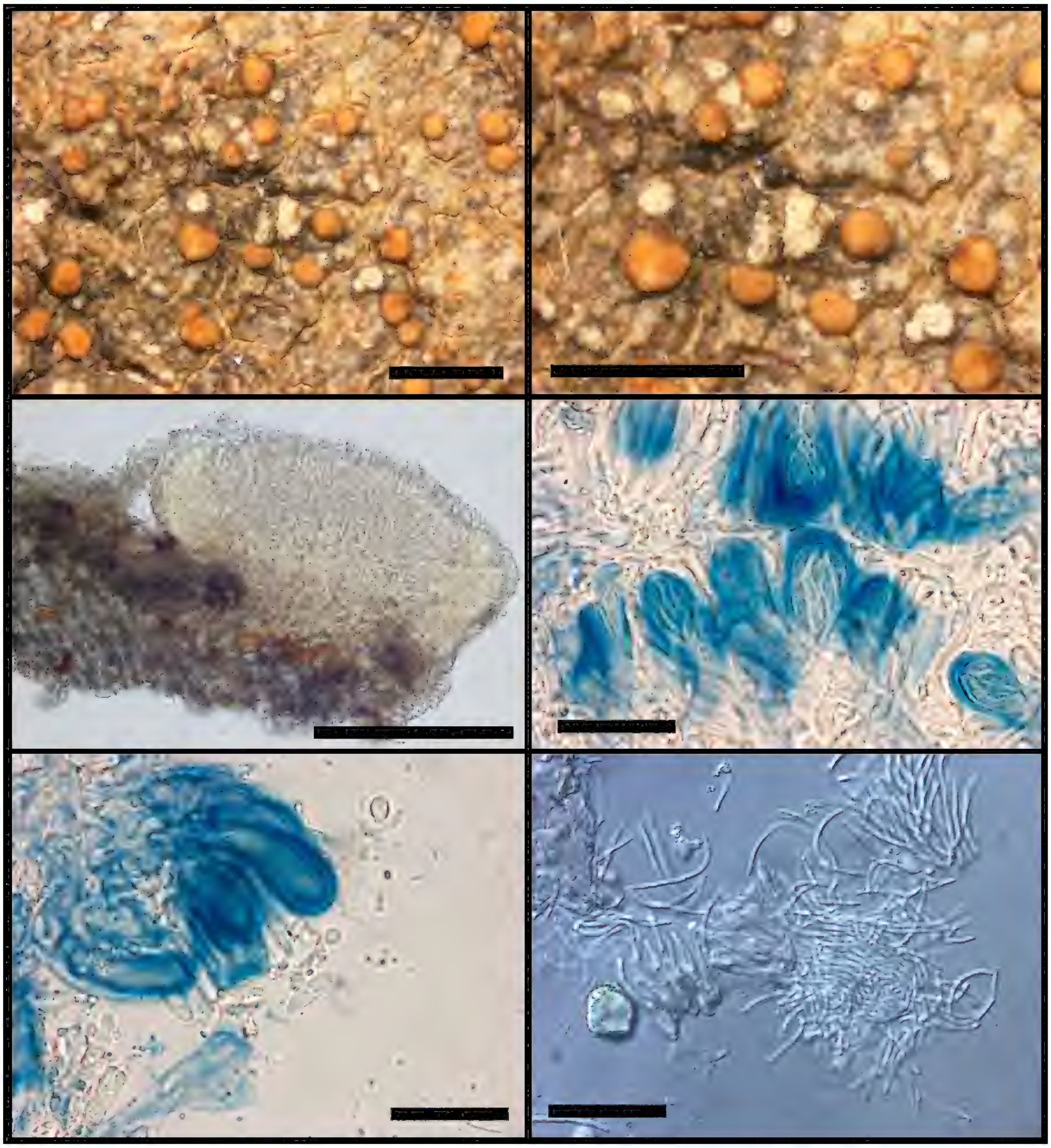

Plate 1. European material of *Lecania croatica* (all from *Zahlbr. Lich. Rar. 81*, FH). Figures 1-2, thallus and apothecia (scale = 1.0 mm). Figure 3, section of apothecium (scale = 100 µm). Figure 4, asci (scale = 20 µm). Figure 5, ascospores and asci (scale = 20 µm). Figure 6, conidia (scale = 20 µm).

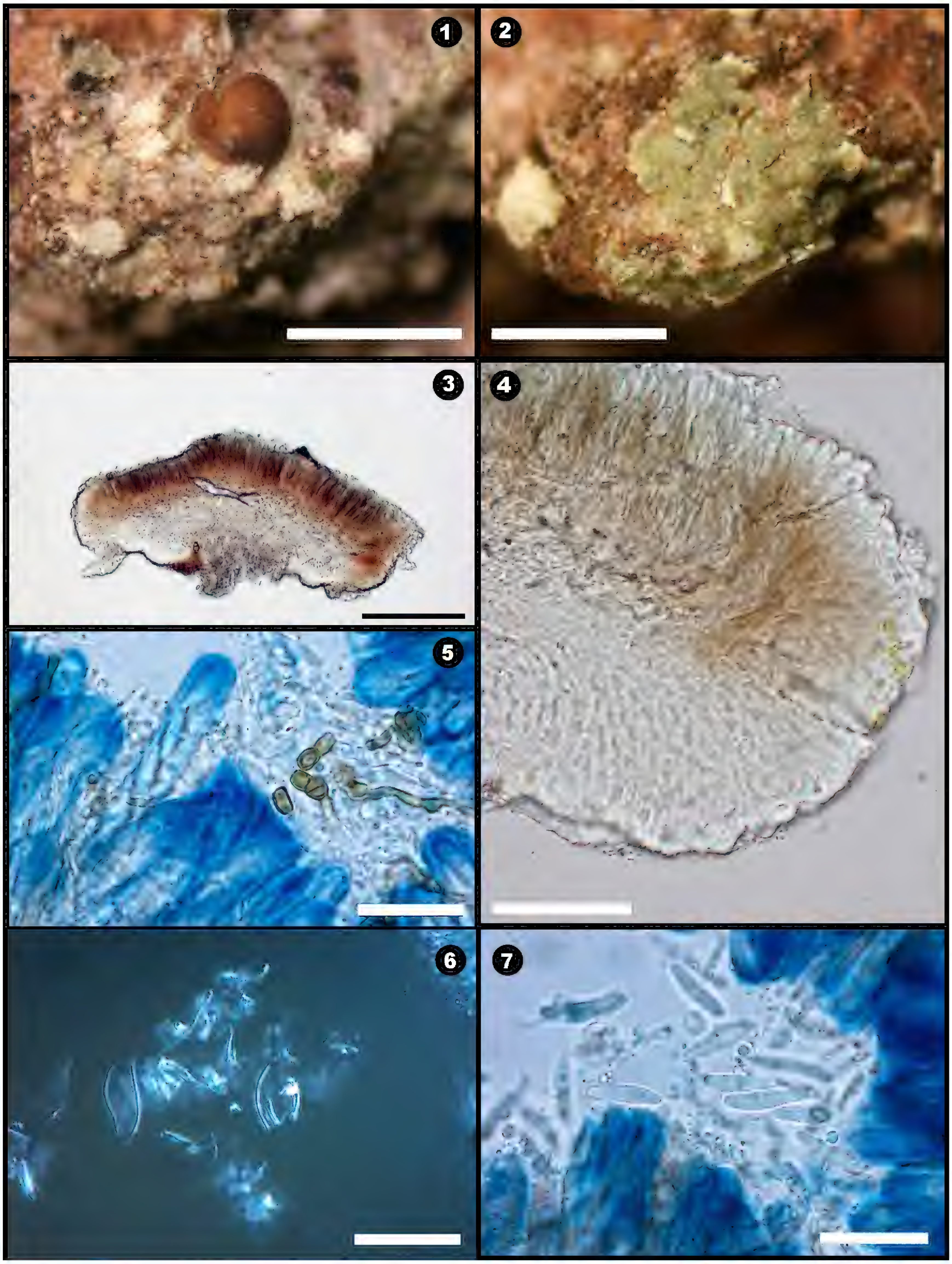

Plate 2. North American material of *Lecania croatica*. Figure 1, soralia and apothecia (*Buck 41693*, scale = 1.0 mm). Figure 2, marginal soralia (*Buck 41693*, scale = 1.0 mm). Figure 3, section of apothecium (*Buck 41640*, scale = 200 µm). Figure 4, exciple (*Buck 41640*, scale = 50 µm). Figure 5, asci (*Lendemer 16530*, scale = 20 µm). Figure 6, conidia (*Buck 41640*, scale = 20 µm). Figure 7, ascospores (*Lendemer 16530*, scale = 20 µm).

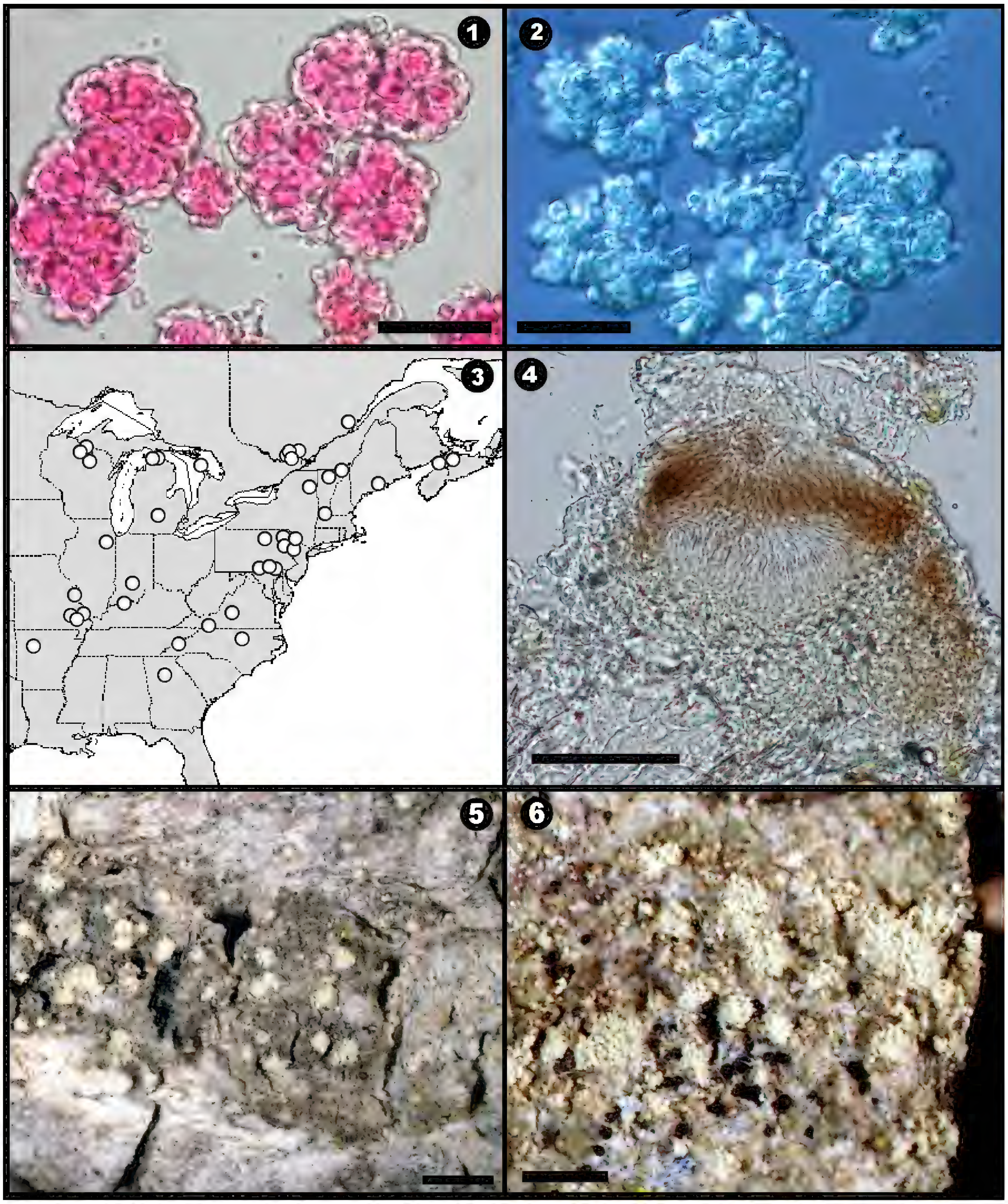

Plate 3. North American material and distribution map of *Lecania croatica*. Figures 1-2, soredia stained with phloxine (left) and in water (right) (*Buck 41640*, scale = 20 µm). Figure 3, geographic distribution of *L. croatica* in North America as presently known based on specimens at CANL and NY. Figure 4, section of pycnidium (*Buck 41640*, scale = 50 µm). Figures 5-6, gross morphology of soralia in final stage of development (*Harris 8815 & Harris 9297*, scales = 1 mm and 0.5 mm respectively).

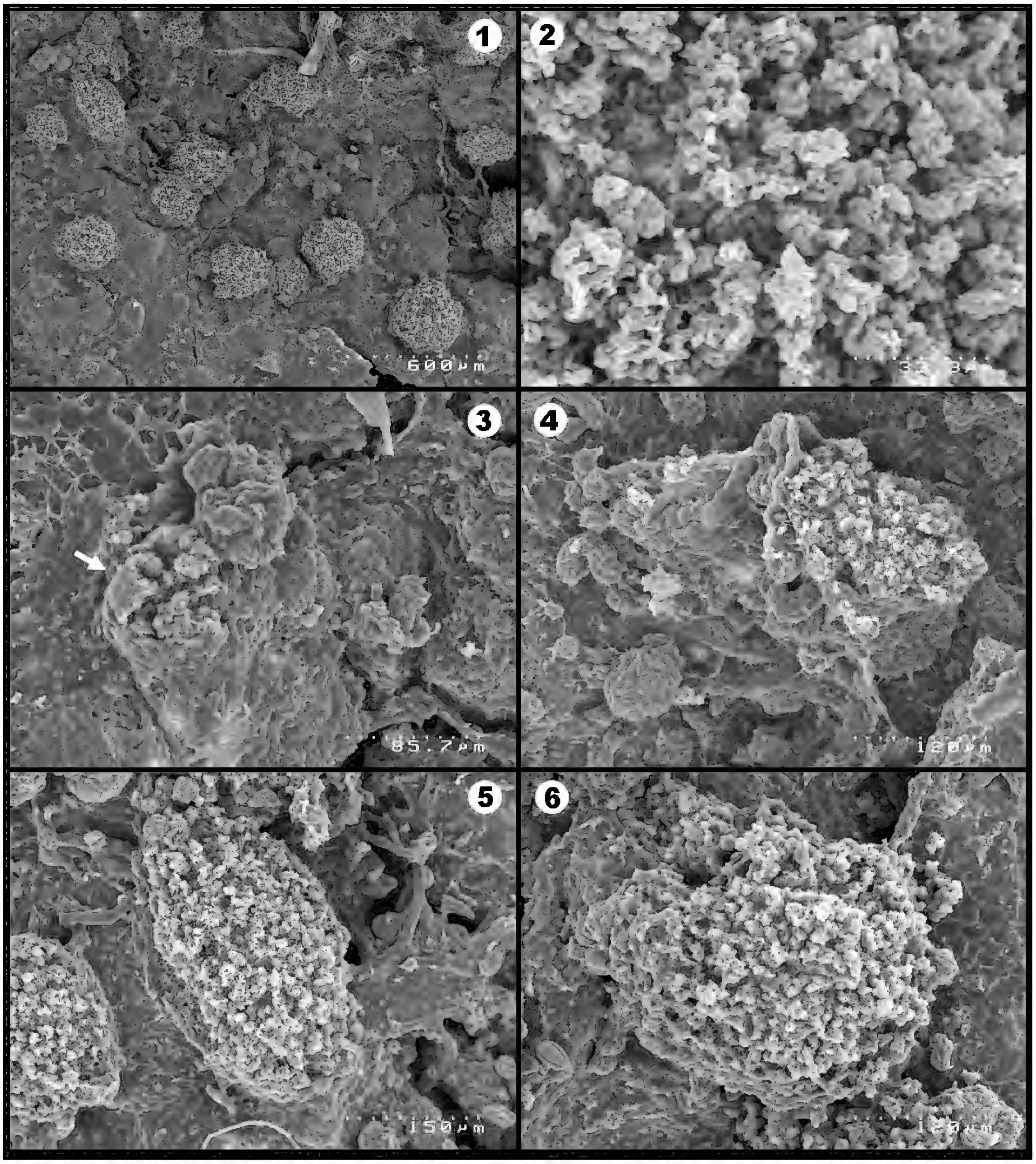

Plate 4. Scanning electron micrographs of *Lecania croatica* (all from *Buck 41649*). Figure 1, gross morphology of thallus and soralia. Figure 2, detail of the soredia. Figures 3-5, ontogeny of soralia: initiating marginally on an areole, expanding over the surface of the areole, and eventually forming a large discrete circular soralium.

shape and size of ascospores and conidia but differs in apothecial color due to the brown pigmentation of the exciple and hymenium. Second, the molecular phylogeny published by Reese Naesborg et al. (2007) does not support placing *Catillaria croatica* in either *Catillaria* or *Lecania*. Exclusion from *Catillaria* is supported by the ascus which is *Bacidia* type. However, morphologically *Catillaria croatica* has much in common with *Lecania*, ascus type, excipular structure, paraphysis type, narrow, septate ascospores and filiform conidia. It is noteworthy that if *L. croatica* is truly a member of *Lecania* it is one of the few species with a biatorine apothecial margin. Therefore, pending a more definitive study, we prefer to accept Kotlov's (2004) placement in *Lecania*.

As pointed out by Hafellner et al. (2005) one of the species most likely to be confused with *Lecania croatica* is *Mycobilimbia epixanthoides* (both sorediate and lack lichen substances). In general they can be separated on the basis of substrate, *L. croatica* on bark, *M. epixanthoides* on bryophytes. The rare corticolous collection of *M. epixanthoides* can be distinguished since even the young soralia are irregular becoming larger irregular patches while *L. croatica* has discrete round soralia which remain distinguishable even when crowded and appearing confluent. The other morphologically similar group in eastern North America is composed of soraliate species of *Biatora* but these are readily distinguished by spot tests from *L. croatica* (all negative): *B. appalachensis* Printzen & Tønsberg (C+, KC+ rose, gyrophoric acid), *B. chrysantha* (Zahlbr.) Printzen (C+, KC+ rose, gyrophoric acid), *B. pontica* Printzen & Tønsberg (C+, KC+ orange, xanthones, *B. printzenii* Tønsberg (C+, KC+ rose, PD+ cinnabar, gyrophoric acid and argopsin).

SELECTED SPECIMENS EXAMINED [ALL COLLECTIONS ARE STERILE UNLESS OTHERWISE INDICATED]. – **CANADA. NOVA SCOTIA.** COLCHESTER CO.: Economy River Wilderness Area, N end of Simpson Lake, 17.v. 2004, on *Acer*, *W.R. Buck 47218* (NY). CUMBERLAND CO.: Cape Chignecto Provincial Park, on *Acer*, *W.R. Buck 47129* (NY). **ONTARIO.** BRUCE CO.: Bruce Peninsula National Park, SW of parking area for Halfway Log Dump, 20.ix.2008, on *Acer*, *W.R. Buck 54177* (NY, fertile), on *Fraxinus*, *J.C. Lendemer 14281* (NY), on *Acer*, *J.C. Lendemer 14293* (NY), on *Acer*, *J.C. Lendemer 14294* (NY). OTTAWA-CARLETON CO.: Ottawa, Gloucester, 21.vi.2001, on *Fraxinus*, *I.M. Brodo et al. 30426F* (CANL). **QUEBEC.** GATINEAU CO.: Aylmer, N of Pink Rd., 9.vi.1995, on *Fraxinus*, *I.M. Brodo 28910 & F. Brodo* (CANL, fertile). LAURENTIDES CO.: Station de Biologie des Laurentides, 27.vii.1997, on *Acer*, *I.M. Brodo 29408* (CANL). PAPINEAU CO.: 3.5 mi N of Mayo, 6.v.1980, on *Fraxinus*, *I.M. Brodo et al. 23605B* (CANL). **CROATIA.** Ad pedum montis Levuridica, ad corticem truncorum Acerum, *J. Schuler*, distributed as Zahlbr. Lich. rar. 81 (FH, fertile). **U.S.A. ARKANSAS.** YELL CO.: Ola, 3.x.1993, *T. Tønsberg 19284* (NY). **GEORGIA.** ROCKDALE CO.: Panola Mountain State Park, 17.iv.2007, *J.C. Lendemer et al. 9005* (NY). **ILLINOIS.** WILL CO.: Joliet Army Training Area – Forest Service Area, 29.v.2001, on *Quercus*, *R.D. Hyerczyk 1677* (NY). **INDIANA.** BROWN CO.: Nashville, S18.xi.2007, on *Quercus*, *L.B. Sparrius 9097* (NY). SPENCER CO.: McCormick's Creek State Park, 18.xi.2007, on *Fraxinus, L.B. Sparrius 9111* (NY). **MASSACHUSETTS.** FRANKLIN CO.: Town of Rowe, just off Tunnel Rd., 19.ix.1998, on *Populus*, *W.R. Buck 34565* (NY). **MAINE.** WALDO CO.: Town of Lincolnville, Ducktrap River Preserve, 28.v.2009, on *Fraxinus*, *R.C. Harris 55501* (NY, fertile). **MICHIGAN.** CHEBOYGAN CO.: Mill Creek SW from US 23, 1.viii.1974, *R.C. Harris 9297* (NY, fertile). EMMET CO.: S of Larks Lake, 1.vii.1974, *R.C. Harris 8815* (NY, fertile). INGHAM CO.: Michigan State University Campus, Baker woodlot, 3.xi.1973, on *Fraxinus*, *R.C. Harris 8436* (NY). 4.xi. 1973, on *Fraxinus*, *R.C. Harris 8444* (NY), on *Quercus*, *R.C. Harris 8443* (NY), 13.xi.1973, on stump, *R.C. Harris 8550* (NY). **MISSOURI.** BOLLINGER CO.: Dark Cypress Swamp Conservation Area, 22.x. 2001, on *Acer rubrum*, *R.C. Harris 45203* (NY). CAPE GIRADEAU CO.: Apple Creek Conservation Area, 13.x.2003, on *Quercus, R.C. Harris 48243* (NY). JEFFERSON CO.: "Twin Canyons", 26.iii.2006, on *Acer*, *J.C. Lendemer et al. 6099* (NY). MADISON CO.: St. Francis River Natural Area, 22.x.2001, on rotting tree, *R.C. Harris 45102* (NY). **NEW JERSEY.** WARREN CO.: Jenny Jump State Forest, 11.ix. 1992, on *Fraxinus*, *R.C. Harris 27922* (NY). **NEW YORK.** ESSEX CO.: Adirondack Mountain Reserve in Ausable Club, 18.ix.2004, on dead *Fagus*, *R.C. Harris 49981* (NY), on *Fagus*, *R.C. Harris 49982* (NY, fertile), on *Fraxinus*, *R.C. Harris 49983* (NY), on *Fagus, R.C. Harris 49984* (NY), on *Betula*, *R.C. Harris 49985* (NY). **NORTH CAROLINA.** ORANGE CO.: Mason Farm Biological Reserve, 30.viii.2007, *G.B. Perlmutter 1176* (NY). **PENNSYLVANIA.** FRANKLIN CO.: Michaux State Forest, W-slopes of Monalto Mountain, 1.vi.2009, on *Quercus*, *J.C. Lendemer 18116* (NY). LACKAWANNA CO.: Lackawanna State Forest, S of Lackawanna Lake, 17.vii.2008, on *Acer*, *J.C. Lendemer 13246* (NY). LANCASTER CO.: Ferncliff Wildflower and Wildlife Preserve, 29.vii.2009, on base of large *Acer*, *J.C. Lendemer 18723* (NY);

Kellys Run Gorge Preserve, 29.vii.2009, on *Acer*, *J.C. Lendemer 18801* (NY). LYCOMING CO.: Tiadaghton State Forest, McIntyre Wild Area, 12.v.2009, on *Carya*, *J.C. Lendemer 16530 & D. Atha* (NY, fertile). MONROE CO.: State Game Lands No. 38, Hypsy Gap, 15.iii.2006, on *Quercus*, *J.C. Lendemer 5906 & N. Howe* (NY). PIKE CO.: State Game Lands No. 209, terminus of Pond Eddy/Firetower Rd., 28.vii.2009, on *Ostrya*, *J.C. Lendemer 18685* (NY). YORK CO.: State Game Lands No. 83, Sawmill Run, 27.v.2009, on *Liriodendron*, *J.C. Lendemer 17920* (NY). **TENNESSEE.** COCKE CO.: Great Smoky Mountains National Park, Gabes Mountain Trail, 0-2 mi E of jct with Maddron Bald Trail, on *Tsuga* branch, *J.C. Lendemer 19024 & E.A. Tripp* (NY).**VERMONT.** ESSEX CO.: Town of Averill, Quimby Country resort property, 19.v.2009, on hardwood, *W.R. Buck 53739* (NY). ORLEANS CO.: Town of Craftsbury, Craftsbury Outdoor Center, 16.v.2005, on hardwood, *W.R. Buck 49141* (NY). **VIRGINIA.** AMHERST CO.: George Washington National Forest, N of US 60 at Long Mountain, 14.v.2000, on *Liriodendron*, *W.R. Buck 36980* (NY). GRAYSON CO.: Jefferson National Forest, Mount Rogers National Forest, 5.iv.2008, on hardwood, *B.P. Hodkinson 8973* (NY). **WISCONSIN.** ONEIDA CO.: Town of Enterprise, Oneida County Forest, 27.iv.2002, on *Betula*, *W.R. Buck 41640* (NY, fertile), on hardwood, *W.R. Buck 41649* (NY); Town of Minocqua, Patterson Hemlocks State Natural Area, 29.iv.2002, on hardwood, *W.R. Buck 41736* (NY, rev. Printzen, fertile), *W.R. Buck 41763* (NY, rev. Printzen, fertile). VILAS CO.: Town of Arbor Vitae, Northern Highland State Forest, 28.iv.2002, on hardwood, *W.R. Buck 41693* (NY, rev. Printzen, fertile).

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Two new species of *Chrysothrix* from eastern North America

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ABSTRACT. – Two new species of *Chrysothrix* from eastern North America are described: *C. chamaecyparicola* to accommodate the North American populations previously referred to as *C. flavovirens*, and *C. susquehannensis,* the first species in the genus with lecanoric acid.

INTRODUCTION

The genus *Chrysothrix* Mont. has recently received considerable attention in the form of taxonomic revisions (Elix & Kantvilas 2007, Harris & Ladd 2008, Laundon 2008, Elix 2009), the description of new species (Jagadeesh Ram et al. 2006), and new floristic reports (Flakus et al. 2006, Nöske et al. 2004). Harris and Ladd (2008) provided a preliminary treatment of the genus in eastern North America and the Ozarks, but since that publication additional specimens have accumulated and taxonomic concepts have evolved. Here we describe two new species from the region, raising the total number reported from North America north of Mexico from eight to nine (Esslinger 2009). The first species, *C. chamaecypericola,* is described to accommodate the North American populations formerly referred to as *C. flavovirens* Tønsberg by American authors (Harris & Lendemer 2005, Harris & Ladd 2008). The second species, *C. susquehannensis*, is known only from the lower Susquehanna River in southeastern Pennsylvania, and is characterized primarily by the presence of lecanoric acid, a substance not previously reported from the genus.

MATERIALS AND METHODS

A significant effort has been made by the first author and his collaborators to document, observe, and collect sterile sorediate and isidiate crustose lichens in conjunction with their field studies in North America. It is these collections that form the basis of the present contribution. All specimens were examined dry using a Baush & Lomb StereoZoom 7 dissecting microscope. Microscopic characters were measured in water and images were captured using an Olympus DP20 digital camera with Microsuite Special Edition. Representative specimens of the new species were also examined with SEM to better characterize and illustrate them. Samples were removed from herbarium specimens with a razor blade and not subjected to fixation, rinsing, or dehydration. They were mounted on aluminum stubs using conductive carbon adhesive tabs and sputter coated for 2 minutes at 10 milliamps with gold. Following coating the specimens were examined with a scanning electron microscope (Hitachi S-2700) with a tungsten filament operating with an accelerating voltage of 20 kv. Digital images were captured using Quartz PCR Image Management System.

All specimens were subjected to chemical analysis using standard spot tests (reagents are abbreviated following Brodo et al. (2001) and Thin Layer Chromatography (TLC). TLC was carried out using solvent systems A and C following the standardized methods of Culberson & Kristinsson (1970). A sample of the type collection of *Chrysothrix susquehannensis* was also studied with High Performance Liquid Chromatography (HPLC). Illustrations were prepared using Adobe Photoshop. Mounts of the thallus were prepared by hand with a razor blade and placed in water. Measurements are based on water mounts.

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TAXONOMIC SECTION

1. *Chrysothrix chamaecyparicola* Lendemer sp. nov.

Mycobank #516676.

Plates 1-2 (Pages 53-54).

Chrysothricis flavovirentis similis sed acidum diffractaicum deficienti differt.

TYPE: **U.S.A. NORTH CAROLINA.** CAMDEN CO.: Dismal Swamp State Park, Dismal Swamp Natural Area, S of Kim Saunders Ditch at 5 mile marker, Atlantic white cedar peatland with sparse hardwoods (*Acer, Magnolia, Nyssa*), 10.xii.2009, on *Chamaecyparis thyoides*, *J.C. Lendemer 20207 & S. Williams* (NY, holotype; isotypes to be distributed as *Lichenes East. N. Amer. Exs. VIII: 373*).

DESCRIPTION. – Harris and Ladd (2008: 34).

ADDITIONAL COLOR ILLUSTRATION. – Harris and Ladd (2008: 32, plate 1, figure 3).

ETYMOLOGY. – The epithet “chamaecyparicola” denotes the strong affinity of the species for bark of the Atlantic white cedar (*Chamaecyparis thyoides* (L.) Britton et al.).

CHEMISTRY. – Rhizocarpic acid. Spot tests: K-, KC-, C-, P-, UV+ orange.

ECOLOGY AND DISTRIBUTION. – *Chrysothrix chamaecyparicola* is a striking and distinctive member of the lichen biota of conifer swamps in temperate and sub-tropical eastern North America. It is often the dominant lichen, covering the trunks of trees in this high humidity, low light habitat. Although the most impressive displays of this species are found in cedar swamps near the coast, the species also occurs on a wide variety of other conifers in inland swamps. Other known porophytes include cypress (*Taxodium*), hemlock (*Tsuga*), and pine (*Pinus*).

The species appears to be most common in the middle-Atlantic region (New Jersey, Maryland, and Pennsylvania), which is also the center of the distribution of its typical host, *Chamaecyparis thyoides*. It is probable that the scattered nature of its occurrences in the coastal plain and Piedmont outside of this region reflect the collection bias that often impacts sterile crustose lichens. We have not revised any specimens that substantively extend the geographic distribution of the species as mapped by Harris and Ladd (2008: 41, plate 3, figure 9).

DISCUSSION. – The new species is described to accommodate the North American populations previously referred to *Chrysothrix flavovirens* (e.g., Harris & Ladd 2008). The name *C. flavovirens* was first used for North American material by Harris & Lendemer (2005) who recognized that many collections of *Chrysothrix* from southern New Jersey and adjacent Pennsylvania could not be accommodated satisfactorily under the names then used for corticolous species in North America (e.g., *C. candelaris* (L.) J.R. Laundon). When reporting *C. flavovirens* from North America the authors were careful to note that the material was chemically discordant from European populations in lacking the *flavovirens*-unknown (which was subsequently shown to be diffractaic acid by Elix and Tønsberg (2004). In light of the fact that the absence of diffractaic acid corresponds to the difference in geographic distribution, we believe that inclusion of the North American populations in *C. flavovirens* is untenable and recognize them here as a distinct species.

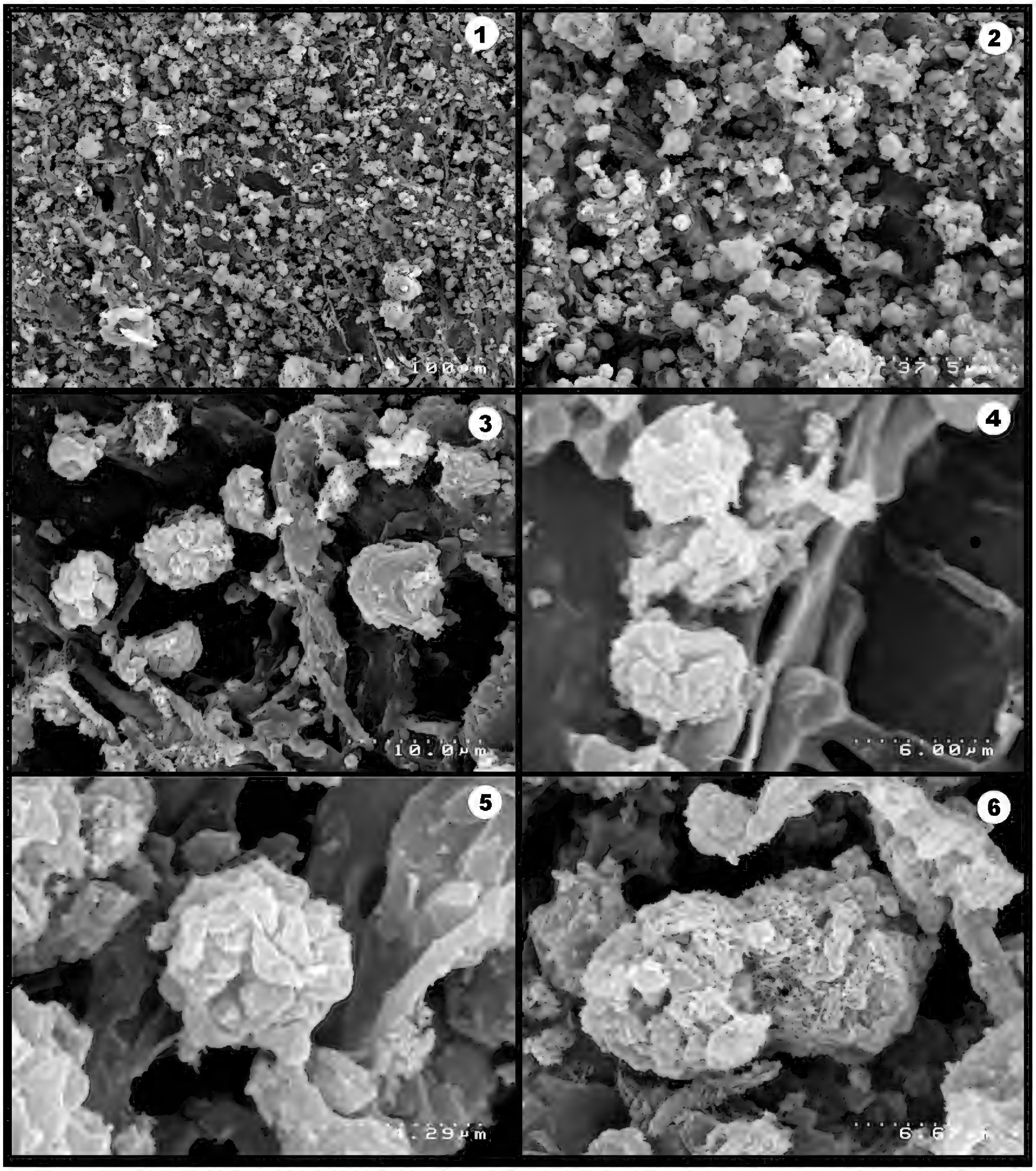

Plate 1. Scanning electron micrographs of *Chrysothrix chamaecyparicola* (all from holotype). Figures 1-2, gross morphology of thallus at low magnifications. Figures 3-6, detail of granules.

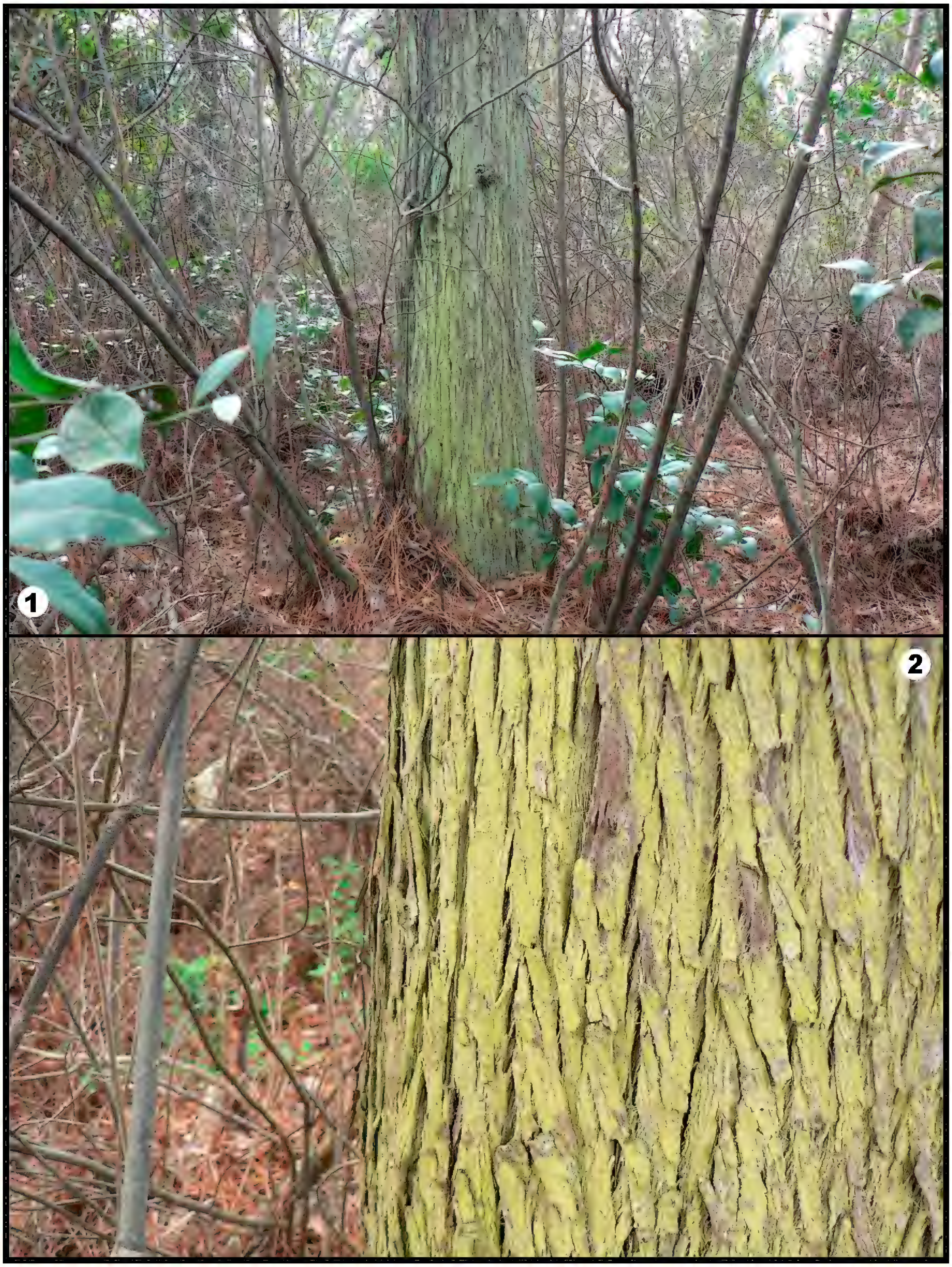

Plate 2. Figures 1-2, habitat of *Chrysothrix chamaecyparicola* (tree from which the type collection was gathered). Photos by Signa Williams.

2. *Chryosthrix susquehannensis* Lendemer & Elix sp. nov.

Mycobank #516677.

Plates 3-4 (Pages 56-57).

> *Chrysothricis onokoensi* similis sed supra muscos crescenti, thallo tenui, acidum rhizocarpicum et acidum lecanoricum ad invicem acidum leprapinicum continenti differt.
>
> TYPE: **U.S.A. PENNSYLVANIA.** LANCASTER CO.: E slopes above Susquehanna River, 0.25-0.5 mi N of confluence of Tucquan Creek and Susquehanna River, schist outcrops/bluffs with oak-gum-pine forest, 8.viii.2009, on humus and mosses on sheltered vertical rock face, *J.C. Lendemer 19364* (NY, holotype; hb. Kalb, isotype).

DESCRIPTION. – Thallus crustose, leprose, dull lemon-yellow to greenish, with the granules sparsely distributed at first, eventually dividing and accumulating into small overlapping heaps that become confluent and form small, poorly defined, 0.1-0.3 mm thick, rosettes with diffuse margins; granules ecorticate, 40-90 µm in diameter, round, with a layer of gelatinized hyaline hyphae surrounding the algal core; hyphae hyaline, 2-4 µm wide, septate, thin walled; photobiont chlorococcoid, cells globose, 9-11 µm in diameter. Apothecia and pycnidia unknown.

ETYMOLOGY. – The epithet "susquehannensis" refers to the Susquehanna River which flows through Pennsylvania on its way to the Chesapeake Bay.

CHEMISTRY. – Rhizocarpic acid (major), epanorin (minor), lecanoric acid (minor), atranorin (minor), conrhizocarpic acid (trace). Spot tests: K-, C+ pink/red, KC+ pink/red, P-, UV+ orange.

ECOLOGY AND DISTRIBUTION. – *Chrysothrix susquehannensis* occurs on small moss cushions and pockets of soil or organic matter clinging to precipitous shaded vertical rock outcrops. It is known only from the type locality although it is probable that more populations occur in the immediate vicinity. Unfortunately the extensive sheer rock faces inhabited by the species are almost impossible to access. The type locality and adjacent areas along the river are well known for hosting a unique and varied flora of vascular plants which was well studied in the late 1890's and early 1900's by Arthur A. Heller and John K. Small (Heller 1893, Small & Carter 1913). Many unusual lichen species also occur in the area including several at the edge of their geographic range (Heller 1893, Lendemer in press.).

It is unlikely that the lack of additional records of this species outside of the lower Susquehanna River valley is due to collection bias because the region was intensively studied in the past by local botanists and in a recent detailed survey by the first author. Further, this species was not encountered by Harris and Ladd (2008) during their revision of the genus *Chrysothrix* in eastern North America. Given its apparent rarity and restricted distribution, *C. susquehannensis* should probably be given protective status at the state or federal level.

DISCUSSION. – The new taxon is distinguished from all other known *Chrysothrix* species by the production of lecanoric acid together with rhizocarpic acid and epanorin. Among the North American species of *Chrysothrix* this new species is distinguished by its unique chemistry as well as its ecology. It occurrs on moss cushions and organic matter whereas the other North American species occur directly on rock or bark. It is morphologically similar to *C. chlorina* (Ach.) J.R. Laundon and *C. onokoensis* (Wolle) R.C. Harris & Ladd in the size of the thalline granules, but differs from those species in having a thinner thallus (0.1-0.3 mm vs. ca. 1.0 mm thick).

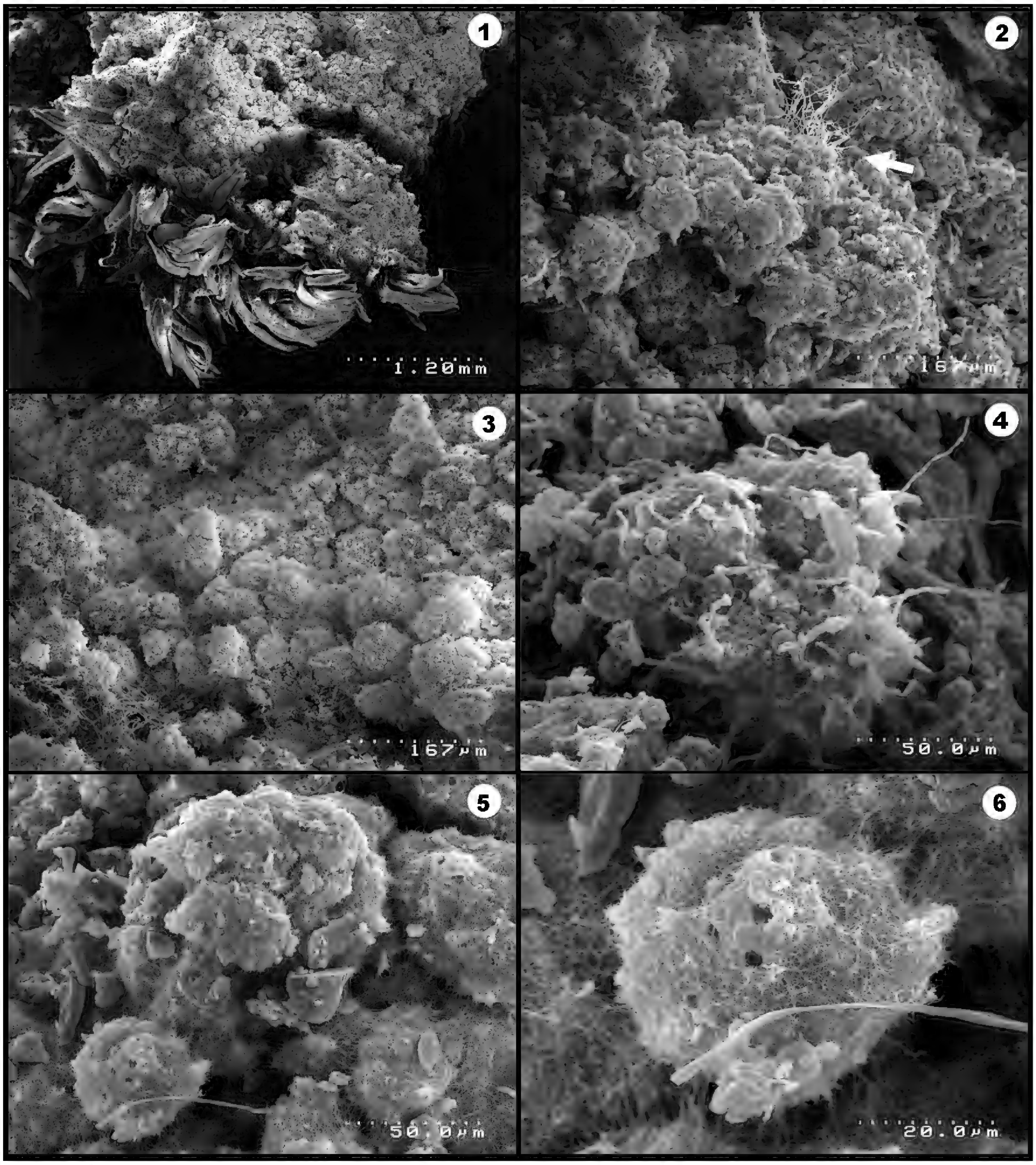

Plate 3. Scanning electronic micrographs of *Chrysothrix susquehannensis* (all from holotype). Figure 1, gross morphology of thallus. Figure 2, edge of thallus (arrow points to hyphae extending outward from the growing edge). Figure 3, thallus surface. Figure 4, "heap" of three granules with hyphae extending outward toward the substrate. Figures 5-6, detail of granules.

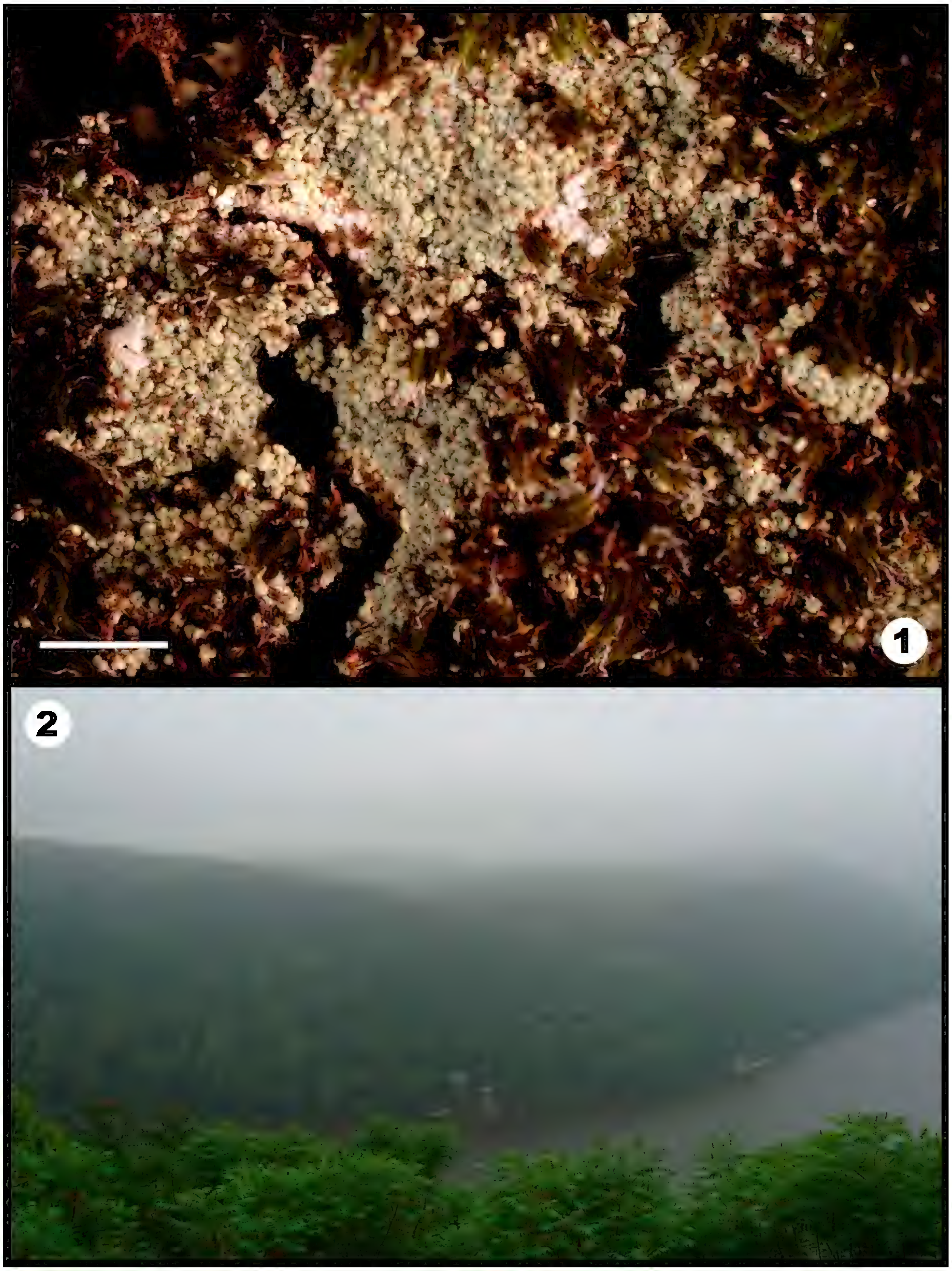

Plate 4. *Chrysothrix susquehannensis*. Figure 1, holotype (scale = 1 mm). Figure 2, rocky cliffs along the lower Susquehanna River, view from Pinnacle Overlook, Lancaster Co., Pennsylvania.

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H. E. Hasse, Lichenist

KERRY KNUDSEN[1]

ABSTRACT. – A short biography of the American lichenologist Hermann Edward Hasse (January 12, 1836-October 29, 1915) is presented. Hasse, who worked mainly in southern California corresponded frequently with Professor William Gilson Farlow and the lichenologist George Knox Merrill about his findings. Some of his letters are preserved in the Archives of the Farlow Herbarium of Cryptogamic Botany. Hasse's relationship with Farlow and Merrill is discussed based on these remaining letters.

KEYWORDS. – California (history), Farlow Herbarium, Lichenology (history), Sullivant Moss Society.

H.E. HASSE: A SHORT BIOGRAPHY

Hermann Edward Hasse (January 12, 1836-October 29, 1915) (Fig. 1) was a lichenologist who collected for about 35 years primarily in southern California. Figure 1 shows Hasse in his uniform from the Civil War; the picture was probably taken on a Veteran's day at the Old Soldier's Home when the survivors donned their uniforms for the annual celebration. He published the historic *Lichen flora of southern California* (1913) covering approximately 400 taxa, as well as 30 other papers and notes on lichens (Fink 1916) including the earlier *Lichens of Southern California* (1898), an 18-page checklist of 307 lichens. Many of his papers were published in *The Bryologist*.

Hasse was born in Freiburg, Germany, on January 12, 1836. His parents migrated to Milwaukee, Wisconsin, when he was 9 years old. "The father, Judge Carl E. Hasse, brought with him a fine library, and the boy grew up in an atmosphere of intelligence" (Plitt 1916). He received his education in public schools. At the age of 19 Hasse became fascinated by botany when he began to work for a druggist "'a thorough chemist and botanist, to whose instruction,' he said he owed 'the predilection for the latter science'" (Fink 1916). Hasse decided to become a surgeon and attended medical school in St. Louis. "Graduating at the medical school at the age of 21, he continued his studies in Europe. He studied at the University of Leipzig, Germany, from 1857 to 1860, then at Prague, Bohemia, and at the University of Würzburg, Germany, where the degree of Doctor of Medicine was conferred upon him in 1861" (Plitt 1916).

Hasse returned to Wisconsin in 1861 and served as a surgeon to the 9th and the 24th Wisconsin Infantry Regiments during the Civil War. "Throughout the war, he carried a copy of the 1857 edition of *Gray's Manual* (*of Botany*), which he kept to his last days as a cherished souvenir, well filled with annotations about plants observed" (Fink 1916). It was in "1880 that he began collecting a herbarium. This herbarium he sold later to Columbia University, just prior to his specializing in Lichens" (Plitt 1916). He maintained an interest in vascular plants even after the study of lichens. In honor of his love of the California vascular flora four plants were named after him: *Carex hassei* L.H. Bailey, *Dudleya virens* ssp. *hassei* (Rose) Moran, *Lycium brevipes* var. *hassei* (Greene) C.L. Hitchc., and *Vicia hassei* S. Watson.

After the Civil War, Hasse practiced medicine in Wisconsin, Arkansas and Missouri. He moved to Los Angeles, California, in 1879 at the age of 43 (Fink 1916). In 1888 he became chief surgeon of the Soldier's Home near Santa Monica, California, a hospital and retirement facility for veterans of the Civil War (Fig. 2). Hasse told Bruce Fink in one of his letters, "I took up with lichens about 1880. But the real incentive was given about 1890, by a circular from the late Doctor Stizenberger, in which he desired contributions of Pacific Coast lichens" (Fink 1916). In 1895, at the age of 59, Hasse published his first

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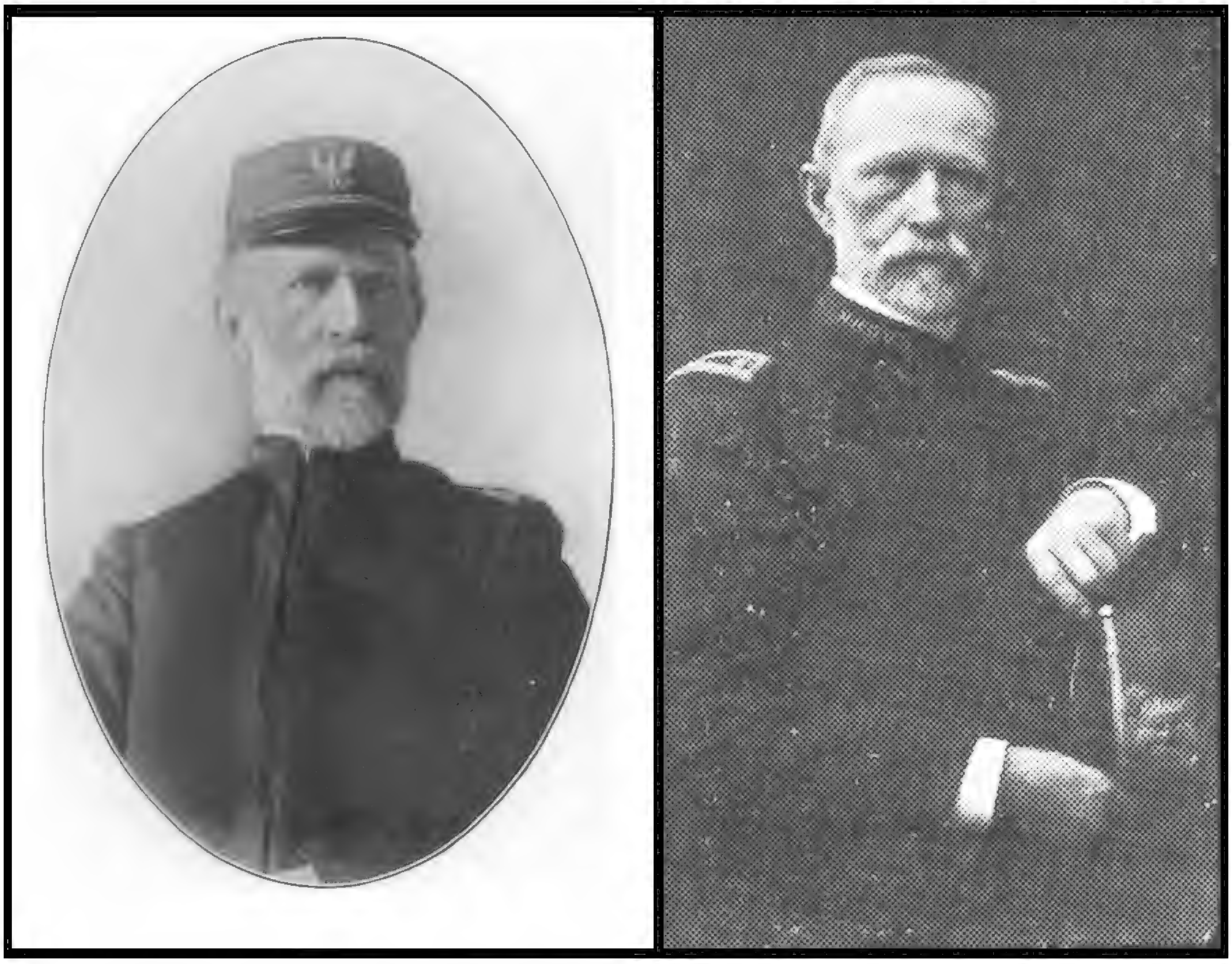


Figure 1. H.E. Hasse (left reprinted from *Mycologia* 8(5): 242. 1916; right reprinted from *Bryologist* 19(2): 31. 1916).

paper *Lichens of the vicinity of Los Angeles I* (Hasse 1895). It was a list of 90 lichens with habitat data in which he published the descriptions of *Rinodina angelica* Stizenb. and *Verrucaria plumbaria* Stizenb. by Stizenberger. Soon after its publication he began corresponding with Bruce Fink, who was a leading North American lichenologist, Professor of Botany and a member of the Sullivant Moss Society, who served at Miami University of Ohio, at the University of Minnesota, and lastly at University of Michigan and compiled the first lichen flora of North America, as well as a flora of Minnesota. They continued their correspondence until Hasse's death (Fink 1916).

Hasse spent much time in the field, visiting the hills and canyons of the Santa Monica Mountains regularly as well as Santa Catalina Island, Palm Springs, the Lake Elsinore area, and the San Jacinto, San Gabriel, and San Bernardino Mountains, even Inyo County in central California, exploring on foot and horseback. His collecting routes appear to show a fondness for completing a long day in the field with a therapeutic soak in mineral springs at Murrieta, Matilija Canyon, Eden Hot Springs, or Palm Springs (which rivaled in esteem Baden-Baden and Evian for its water quality). "His repeated visits to out-of-the-way haunts resulted in establishing a friendship with many a recluse, an isolated fisherman, or a lonely shepherd" (Plitt 1916). And no doubt he did some doctoring. One of his specimens I saw was rolled in a letter from a man thanking him for curing a long-suffering complaint of the bowels.

It's impossible to know how many lichen collections Hasse made. He filed his lichens by lot number in which he placed specimens he thought were the same taxon even if collected at different times and sometimes different sites (Hasse 1896a; Fig. 3). He changed numbers on packets sometimes when he changed identifications. He had eventually over three thousand lot numbers, before he stopped writing them on his labels. Based on my estimate of the number of specimens at New York Botanical Garden (NY) and Farlow Herbarium (FH), he collected over 6,000 individual specimens.

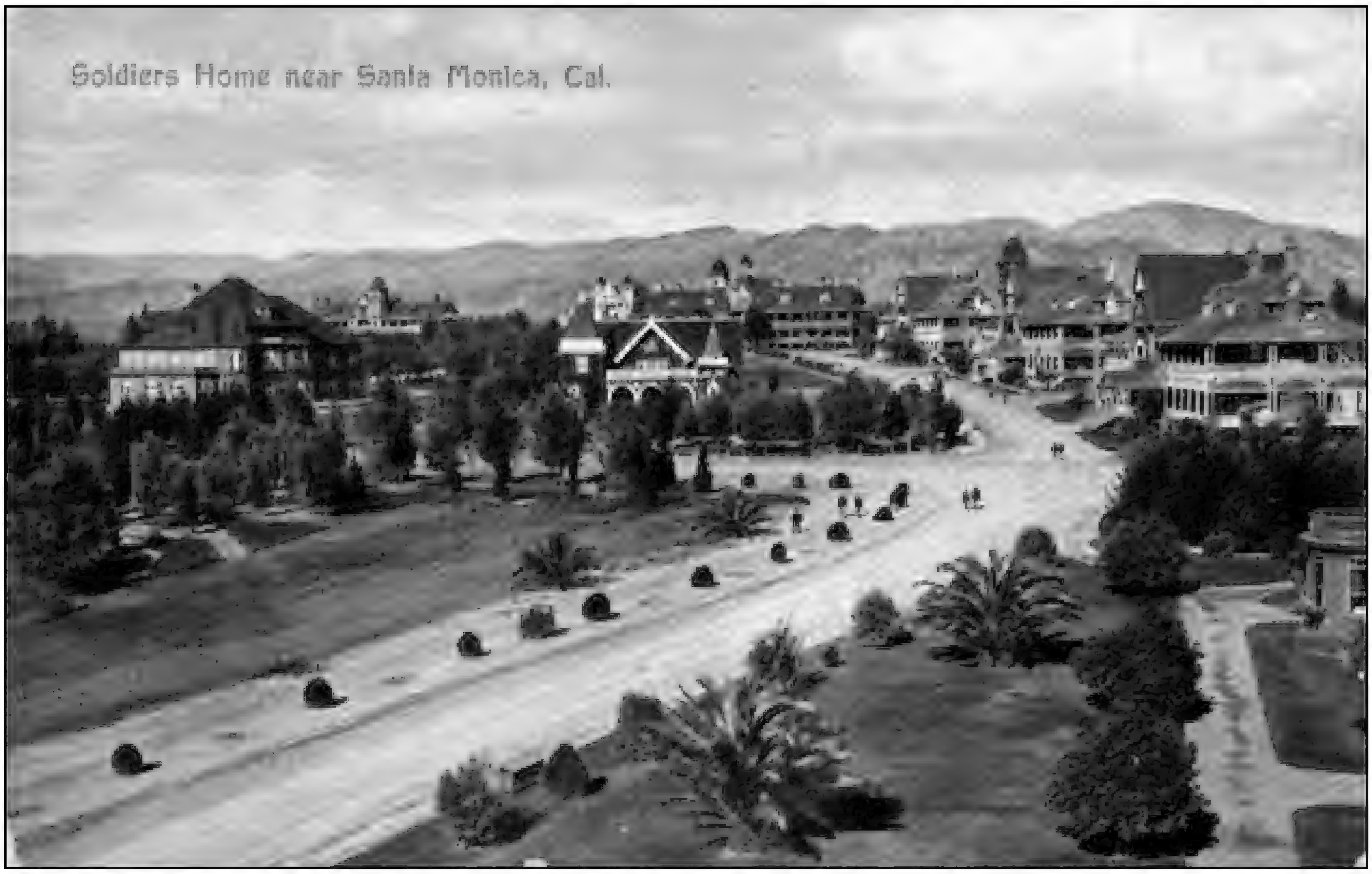
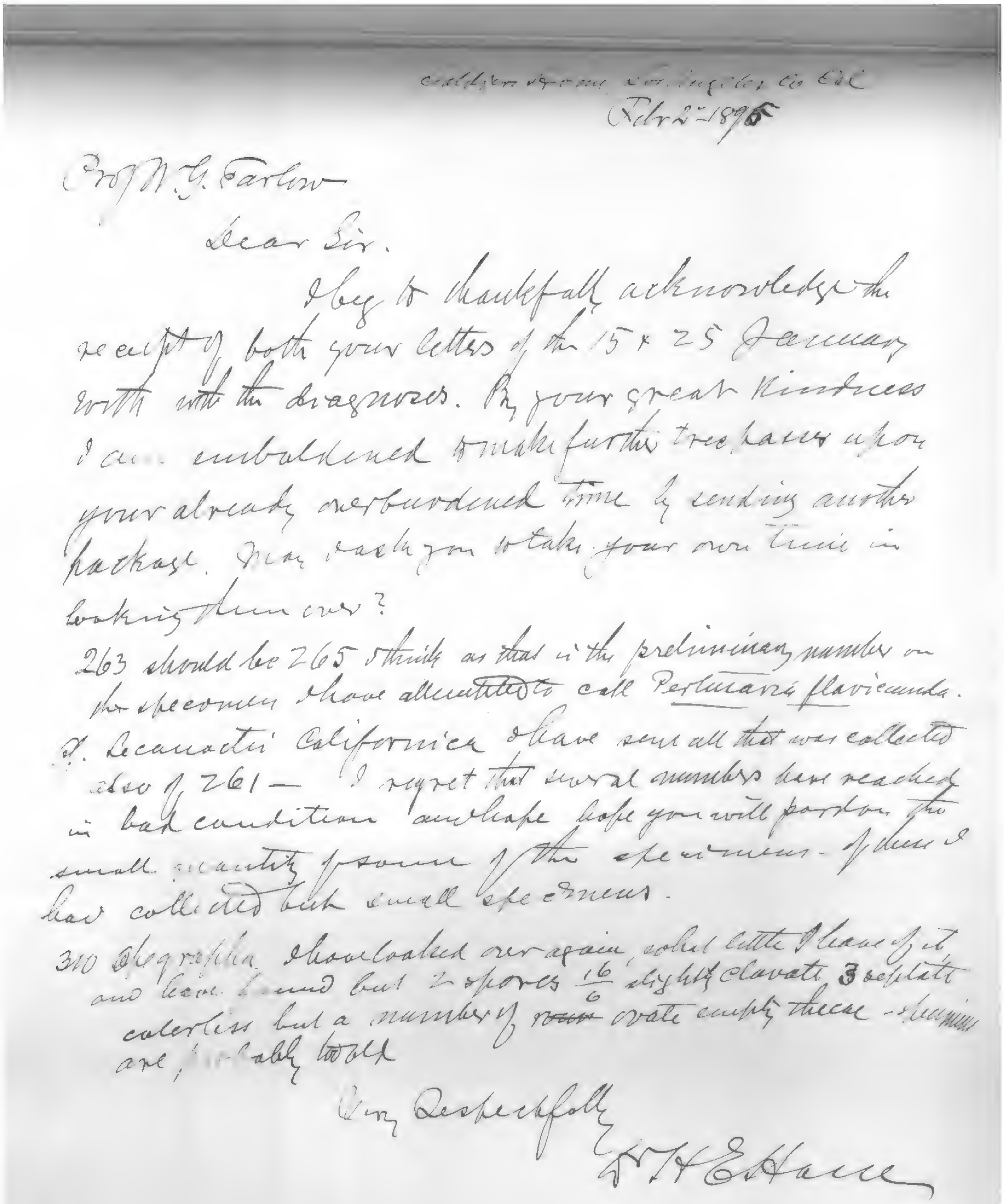


Figure 2. Postcard view of Old Soldier's Home, Santa Monica, California.

Hasse began corresponding with William Gilson Farlow in 1895. Farlow was at that time Professor of Cryptogamic Botany at Harvard. Hasse got a set of diagnoses back from Farlow on lost letters dated January 15 and 25, 1896 (Hasse 1896a; Fig. 3). Hasse told Fink (1916): "Professor Farlow has, with great kindness, helped me out, but I am fearful of encroaching too much upon his time." In 1896 he published *Lichens of the vicinity of Los Angeles IV*, reporting 17 lichens identified by Farlow (Hasse 1896c). During this period he began corresponding with the Finnish lichenologist William Nylander. In 1897, Hasse published *New species of lichens from Southern California as determined by Dr. W. Nylander and the late Dr. Stizenberger* (Hasse 1897). Stizenberger had died the year before. In the publication about the new species from southern California he published the first species descriptions sent to him by Nylander. Around the time of the sudden death of Nylander at his work table in Paris in 1899, Hasse began corresponding with the Austrian lichenologist Alexander Zahlbruckner and sending him specimens. Zahlbruckner actually published a number of species from California collected by Hasse (Zahlbruckner 1900, 1902). "The three European lichenists frequently sent the names of new species with very brief diagnostic notes or none at all. In some instances descriptions were written later by themselves, or perhaps more often by Doctor Hasse as we infer from his statements in letters to the present writer" (Fink 1916). Today many important Hasse types and specimens are in the Stizenberger herbarium (ZT), the Nylander herbarium (H-NYL), and the Zahlbruckner herbarium (W). Hasse also sent some specimens to Bouly de Lesdain (Hasse 1906b). The French lichenologist eventually described *Thelocarpon hassei* B. de Lesd. from a Hasse collection from the San Jacinto Mountains (de Lesdain 1930). Any of Hasse's specimens in de Lesdain's herbarium, including the type of *T. hassei,* would have been destroyed in the bombing of Dunkirk in World War II.

Hasse published the first important papers on the lichens of the Channel Islands of California: *The lichen flora of San Clemente Island*, a list of 22 lichens with habitats (Hasse 1903a) and *Contributions to the lichen flora of the California Coast Islands,* comprised of two lists containing over 100 lichens with localities (Hasse 1903b). He was in contact with the famous island botanist Blanche Trask and several lichens collected by her were included in his herbarium and are now in the Farlow Herbarium.

In 1905, at the age of 69, Hasse retired from the Old Soldier's Home and devoted the rest of his life to the study of lichenology. In those days before Social Security, his retirement was probably financed by the sale of part of his private lichen herbarium. In 1906, John I. Kane presented to the New York



Soldiers Home, Los Angeles Co Cal
Febr 2 – 1895

Prof W. G. Farlow

Dear Sir.

I beg to thankfully acknowledge the receipt of both your letters of the 15 + 25 January with with the diagnoses. By your great kindness I am emboldened to make further trespasses upon your already overburdened time by sending another package. May I ask you to take your own time in looking them over?

263 should be 265 I think as that is the preliminary number on the specimen I have attempted to call Pertusaria flavicunda. [illegible] Lecanactis Californica I have sent all that was collected also of 261 — I regret that several numbers have reached in bad condition and hope you will pardon the small quantity of some of the specimens – of these I have collected but small specimens.

310 Opegrapha I have looked over again what little I have of it and have found but 2 spores $\frac{16}{6}$ slightly clavate 3 septate colorless but a number of ~~[illegible]~~ ovate empty thecae – [illegible] are probably too old

Very Respectfully
H. E. Hasse

Figure 3. Letter from Hasse to Farlow preserved in the Archives of the Farlow Herbarium of Cryptogamic Botany.

Botanical Garden about 3,000 specimens and many duplicates from Hasse's herbarium (Fink 1916). Until his death, Hasse was regularly in the field, especially in the Santa Monica Mountains, and even visited Arizona. He continued to collect regularly in the field. "He became a member of the Sullivant Moss Society in 1905; in 1913 he became curator of the Society's Lichen Herbarium. During the three years while he was its curator 1120 additional specimens were added to the herbarium; of this number 397 are from Southern California, collected by Doctor Hasse himself" (Plitt 1916). Hasse began publishing in *The Bryologist* in 1908. In 1910, Hasse described his first species, *Bacidia clementis* Hasse and *Haematomma pacifica* Hasse (Hasse 1910). Hasse published 17 species (Fink 1916). His work culminated in the *Lichen flora of southern California* (Hasse 1913). After its publication, he continued to publish in *The Bryologist* additions to the flora of western North America and new species.

Hasse became ill in 1915 and after several months died on October 29, 1915 (Andrae 1915), at the age of 79, leaving behind his wife and children. In eulogy, Plitt (1916) wrote of Hasse's character: "… it was with the greatest difficulty that he could be dragged to even the most informal social affairs by his family. He derived the keenest pleasure from his botanical correspondence and seemed to feel his lichen friendships were a haven and refuge from all the sordid and petty insincerities of common day dealings. He detested 'bluff' and insincerity and was very quick to detect the hypocrisies of ordinary social intercourse. The old soldiers cherished a warm affection for him—'the old Dutch Doc'—feeling sure of his absolute sincerity in caring for their interests. How keenly the city of Santa Monica felt the loss of their old doctor was beautifully shown on the day of his funeral by the lowering of the city flag to half mast in his memory. This tribute is the more interesting when it is borne in mind that Dr. Hasse had practically no conception of 'politics', and had never been 'prominent' in the usually accepted meaning of this word. It was an unlooked for tribute to his quarter century of being a good neighbor in the fullest sense."

Bruce Fink wrote of Hasse with great affection in his obituary which is filled with important biographical information (Fink 1916). He held Hasse's work in great esteem. Hasse also corresponded with G. K. Merrill, the North American lichenologist. In his obituary of G. K. Merrill, Plitt (1928) wrote, "I soon learned that he (G.K. Merrill) valued the opinions of his contemporaries very lightly, he criticized them all, I often thought, most unfairly. Of them all, he probably liked Dr. Hasse best, and spoke of him 'as an indefatigable collector deserving credit for his labors.'"

Hasse collected approximately 75 taxa new to science (Fink 1916). Ten lichen species were named after Hasse by Bouly de Lesdain, Fink, Herre, Imshaug, and Zahlbruckner (who described six of the species) (Index Fungorum 2010).

Typical of Hasse was his letter to Bruce Fink in 1905: "As to the very kind mention you have made of my very unworthy self in the historical part of your paper, I must say that I can scarcely deserve so much credit as you have awarded me. It has been almost entirely a matter of muscle and luck rather than brains in collecting species" (Fink 1916).

H.E. Hasse and W.G. Farlow

Like Hasse, William Gilson Farlow (Dececember 17, 1844-June 3, 1919) (Fig. 4) was trained as a physician and received his M.D. in 1870. But in July, 1870, Farlow was appointed to assist Asa Gray, Fisher Professor of Natural History at Harvard University. Farlow was assigned to teaching cryptogams, which he specialized in for the rest of his life. Eventually in 1879, Farlow was appointed Professor of Cryptogamic Botany at Harvard, a position he held until his retirement in 1896.

In the Archives of the Farlow Herbarium of Cryptogamic Botany, one of the bound volumes of Farlow's letters includes 10 letters from Hasse to Farlow, ranging from February 25, 1896, to March 20, 1913. We do not have Farlow's letters to Hasse. The letters from Hasse do not give a continuous narrative, are formal and short, and generally refer to the exchange of specimens. Hasse is very deferential and formal with Farlow, who he addressed as "Sir". As Hasse told Bruce Fink "…I am fearful of encroaching too much upon his time" (Fink 1916).

In the first letter that is kept in the Archives of the Farlow Herbarium of Cryptogamic Botany, dated February 25, 1896 (Hasse 1896a, Fig. 3), Hasse refers already to earlier correspondence with Farlow with diagnoses of specimens he had sent Farlow. This first letter is the most important one of the ten, because Hasse gives us valuable information on his lot numbers which are part of the labels on the specimen packages. "263 should be 265 I think as that is the preliminary number on the specimen I have [word unclear] to call *Pertusaria flavicunda*." Thus in problems of types, etc., in dealing with specimens collected by Hasse, the numbers on packets are arbitrary, based on a lot system, and may not even have been changed after Hasse changed determinations. Problems of types have to be solved by dates and places of collections. Collections several years apart can have the same number. The specimens of a species may have a different number on each packet, based on what lots he originally assigned each specimen to in his herbarium.

On June 1, 1896 (Hasse 1896b), Hasse wrote, “Many thanks for your kindness in assenting to look over my lichens, many of which I am unable to diagnose for want of literature and those that are diagnosed I am not sure of." Hasse complained of his lack "also of authentic specimens for comparison.” Hasse said “uncertainty confronts me at every step and every collecting trip for lichens is like an excursion into a foreign country without guide or interpreter.” In our time of the internet and relatively easy access to literature, herbarium loans and images, one can easily underestimate the problems Hasse faced studying the lichen flora of southern California. Adding to his problems, Hasse had never formally studied cryptogamic botany, never had the kind of training he had received as a surgeon. And there was no cryptogamic herbarium in Los Angeles. The only other lichenologist in California was Albert W.C.T. Herre, who began studying lichens in central California in 1900 (Herre 1942) and with whom Hasse corresponded and exchanged duplicates. I have seen no evidence that they actually met.

On November 19, 1915, Hasse’s daughter Elisbeth Hasse Andrae wrote Farlow, “My father, Dr. H.E. Hasse, passed away October 29 after an illness of some months, during which time he was obliged to neglect compiling a list of his lichens as he had intended” (Andrae 1915).

Friends in Los Angeles helped Mrs. H.E. Hasse organize and pack his specimens. On February 4, 1916, she wrote Farlow that Hasse’s lichen collection had already been shipped to Farlow in “four or five” cases (Mrs. H.E. Hasse 1916).

Hasse’s herbarium was eventually integrated into the general collection at the Farlow Herbarium, where it forms an important part of the lichen herbarium. The exact number of specimens is unknown, but also includes Hasse specimens sent to G.K. Merrill and Herre, and often several specimens of the same number from Hasse’s Lichenes Exsiccati distributed by the Sullivant Moss Society as well as specimens Hasse received from other lichenologists.

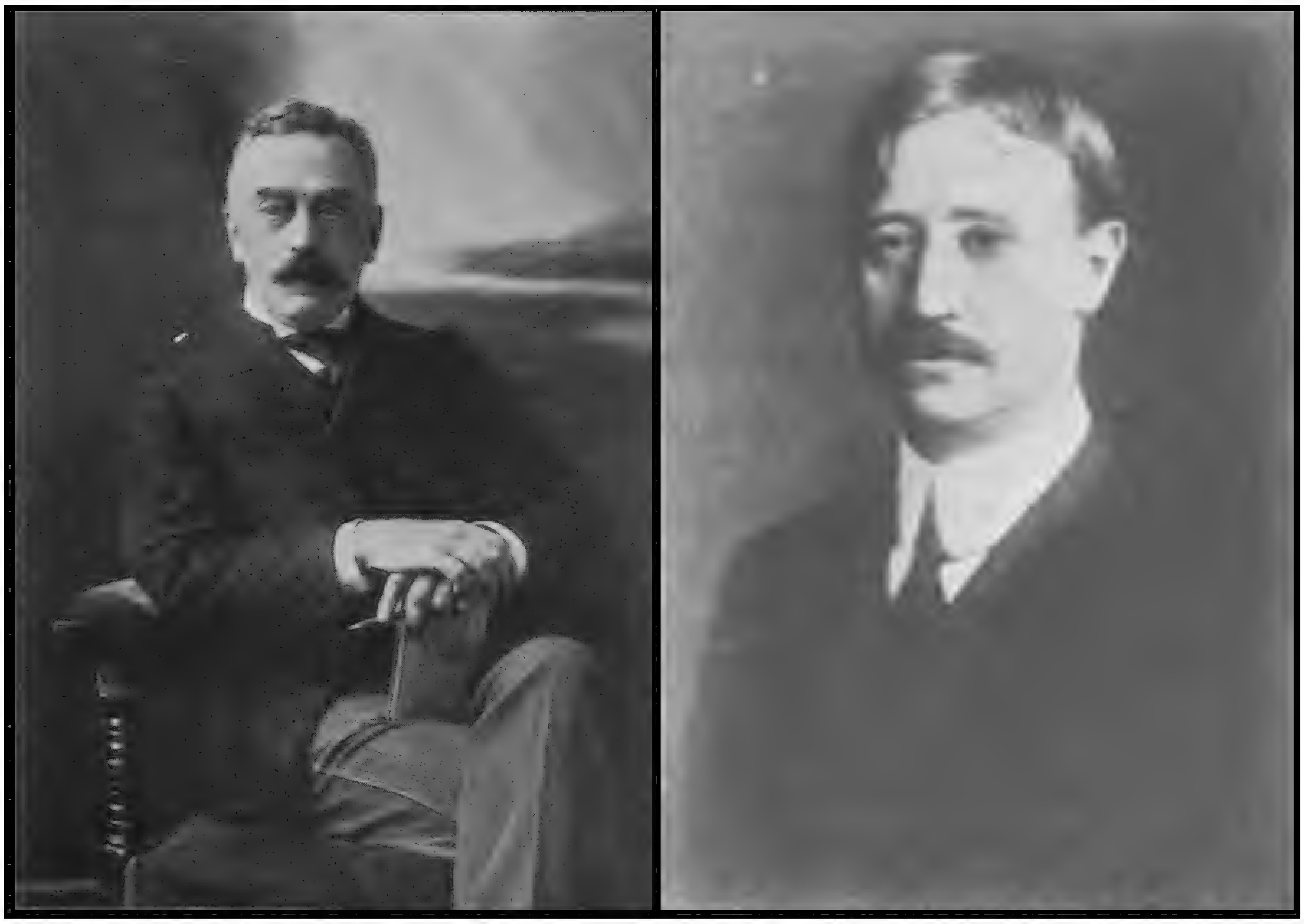


Figure 4. W.G. Farlow (left, reprinted from *Journal of Mycology* 9(1): i. 1903) and G.K. Merrill (right, reprinted from *Bryologist* 31(4): 69. 1928).

H.E. HASSE AND G.K. MERRILL

George Knox Merrill (October 16, 1864-October 21, 1927) (Fig. 4) was an important North American lichenologist and close friend of C.C. Plitt, who wrote an informative obituary of Merrill (Plitt 1928). Born in Maine, G.K. Merrill lived his early life in Boston and attended Harvard for a short time. He began to work as a journalist. In his early twenties he settled in Rockford, Maine, where he spent the rest of his life. He was married twice and had no children. He was actively engaged in local politics and even served on the Board of Assessors for 7 years. He had multiple interests including photography, mineralogy, portrait painting, and botany. The area within ten miles of his home was rich in lichen diversity and he became interested in lichenology sometime around the turn of the 20th century. Merrill eventually collected over 550 taxa within ten miles of Rockland but never finished compiling a flora of Knox County in Maine. In 1905, he published his first paper "Lichen Notes No. 1" on *Cladonia verticillata* and its forms (Merrill 1905). He remained interested in the genus *Cladonia* throughout his life. He published around 37 papers on lichens in journals and as book chapters in the next 21 years, including studies of lichens from Alaska, Canada, Santa Catalina Island in California, Florida, Java and Peru (Culberson et al. 2008). He identified lichens regularly for other collectors and for scientific expeditions, usually around 1000 specimens a year (Plitt 1928). He published many new species and built an excellent herbarium which was purchased by the Farlow Herbarium after his death.

In Merrill's bound letters in the Archives of the Farlow Herbarium of Cryptogamic Botany are 14 letters Hasse wrote to Merrill from September 11, 1904 to February 16, 1915. There are no copies of Merrill's replies to Hasse. Over those years they exchanged lichens, determinations, and contacts, which are the main substance of the letters.

In the beginning of their correspondence Merrill sent his photograph to Hasse after receiving a photograph of Hasse apparently from Fink (Hasse 1904a, 1904b). Hasse says he will "prize" Merrill's photograph and tells him he also has a prized photograph of Edward Tuckerman (Hasse 1904b). Hasse suggested Merrill should get Part Two of "Tuckerman's Synopsis" (Hasse 1904b) for identification which Hasse used to determine some of specimens Merrill sent him from Maine.

In 1905 Merrill requested from Hasse *Cladonia* specimens from California. As now, in southern California's arid climate, *Cladonia* were relatively rare, especially in the Santa Monica Mountains, and Hasse said he did not have many and would send what he could collect. Hasse wrote "The *Cladonia* of my region are not to boast greatly about but such as the country produces you shall have." (Hasse 1906a).

Hasse's letters to Merrill are more relaxed than his letters to Farlow. Based on Plitt's statement (Plitt 1928) about Merrill's highly critical attitude, we can imagine what he told Hasse about Clara E. Cummings." Hasse replied, "I confess to you sub rosa your experience confirms my impression" of "Miss Cummings" (Hasse 1906b). Hasse thought she was concerned only in using him for her Lichenes Boreali-Americanici and "she upbraided" Hasse for sending his specimens to Europe for determinations as if he was showing "disloyalty to the flag." For a patriotic veteran as well as a German-American who was regularly in correspondence with some of the imminent European lichenologists of his time, he must have found this particularly offensive. Hasse said he only sent Cummings some lichens he could not determine and of which he said he had "galores". Hasse's comments though show no real anger or vindictiveness, just some ironic humor.

According to Plitt (1928), Merrill himself was only critical of Hasse accepting Zahlbruckner's system for the *Lichen Flora of southern California* (1913), but apparently never mentioned it to Hasse. Merrill himself eventually adopted the Zahlbruckner system because of its universal acceptance.

In Hasse's last short letter to Merrill (Hasse 1915a) he graciously accepted Merrill's opinion that *Blastenia herrei* Hasse was a synonym of *Lecanora atrosanguinea* Merrill and said he would send a correction to *The Bryologist* which was one of Hasse's three last papers, all published in the same issue (Hasse 1915b).

CONCLUSION

It was a pleasure to sit in the Farlow Reference Library of Cryptogamic Botany and read H. E. Hasse's letters to W.G. Farlow and G.K. Merrill. They are important historical documents which brought to life for me the man whose specimens I was studying on the first floor of the Farlow Herbarium. What impressed me most was that the rather mundane discussions of exchanges and determinations that dominate the letters were not much different from my normal email exchanges with my friends who work on lichens.

I will never forget Hasse's comment on studying the lichens of southern California in the end of the 19th century: "uncertainty confronts me at every step and every collecting trip for lichens is like an excursion into a foreign country without guide or interpreter" (Hasse 1896b). Thanks to his courage to press forward into the unknown of lichenological wonders, we are now able to form a picture of the lichenized fungi biota of the Santa Monica Mountains at the beginning of the 20th century, to see what has been lost through the rapid urbanization of the Los Angeles area and to realize how precious is what remains of a biota that was as diverse as that of the Channel Islands.

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Observations of Mortality in a Small Population of the Endangered Lichen *Erioderma pedicellatum*

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ABSTRACT. – A brief account of the authors' observations on mortality in a small population of *Erioderma pedicellatum* in Nova Scotia, Canada, is presented.

INTRODUCTION

The boreal felt lichen (*Erioderma pedicellatum* (Hue) P.M. Jørg.) is an epiphytic foliose lichen found in the temperate and boreal northern hemisphere. The world population of boreal felt lichen has been listed as critically endangered by the International Union for the Conservation of Nature. Historically the lichen was found in Scandinavia, Newfoundland and Maritime Canada (Clayden 1997). Only two locations are known to exist in Norway (Holien 2006). The Atlantic population, which occurs in Nova Scotia and formerly in New Brunswick, has been listed as endangered under the Canadian federal Species at Risk Act and provincially under the Nova Scotia Endangered Species Act. It is likely extirpated from New Brunswick (Cameron 2004). The boreal population on the Island of Newfoundland is the largest known population, but appears to be declining (Goudie et al. in prep.). In Nova Scotia the population has seen a 90% decline between the early eighties and late nineties (Maass & Yetman 2002).

There are currently 180 thalli at 30 sites in Nova Scotia. All sites have been permanently marked and are re-visited at least every 12 months. Permanent marking consists of staking and tagging all trees at each site and recording position (height and orientation) of thalli on trees. Detailed site location data ensures that thalli can be re-located if still present. Annual data recorded includes size (height and width) and health conditions of individual thalli (grazing, necrosis, etc.). Return visits to each site varied, with the oldest sites having been visited five times and the most recent sites being visited only once. About 57% of sites have had four return visits.

With such a small population size, there is little confidence in assessing population trends. However, a small population allows intimate knowledge of each thallus, thus we are able to determine the fate of several individuals. This paper documents the mortality and decline of twenty-five thalli. We present our assessment of the most likely cause of the mortality and decline. Although these observations are anecdotal, they may provide some insight to the complexity of managing this endangered population.

Twenty-five of seventy-six (33%) *Erioderma pedicellatum* thalli in Nova Scotia observed for at least three years are dead or almost entirely necrotic. Recruitment is very low with only two new juveniles detected since the study began. All thalli that died during the study were found on live trees.

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OBSERVATIONS

GASTROPOD GRAZING

During a return visit to the Sixth Lake site in fall 2004, evidence of extensive grazing on the one *Erioderma pedicellatum* thallus at the site was observed. About 60% had been grazed but it showed no necrosis, loose attachment or other health problems. It was noted that about 80% of trees at the site harboured slugs on the trunks. *Arion subfuscus*, a non-native introduction from Europe, was the dominant arboreal slug, making up approximately 80% of slug individuals found on trees. The only other species observed was a native species identified as *Pallifera dorsalis*. Other lichen species with evidence of slug grazing included *Coccocarpia palmicola, Hypogymnia physodes* and *Parmelia squarrosa*.

Disappearance of two thalli at the Jacket Lake site may also have been caused by grazing. When this site was visited in August, 2006, it was noted that two mature thalli were healthy with minimal evidence of grazing. We failed to locate the two thalli on the same tree during a return visit in March, 2007. Careful examination of the locations on the tree where the thalli had been revealed small thallus fragments that showed evidence of grazing. The Jacket Lake site is less than 2 km from the Sixth Lake site. It cannot be determined if grazing was entirely responsible for the loss of these two thalli. It is, however, significant to note the rapid loss (less than 7 months) of these two healthy thalli.

Invertebrate grazing on lichens has been well documented and gastropods have been the subject of numerous studies (Baur & Baur 1997, Benesperi & Tretiach 2004, Coker 1967, Lawrey 1980, Lawrey 1983). Some investigations suggest mature lichens recover from gastropod grazing (Gauslaa et al. 2006, Fröberg et al. 1993). however, Asplun and Gauslaa (2008) indicate that juvenile thalli may be vulnerable in certain habitats. Previous studies have documented native gastropod impacts. After finding the results reported above at Sixth Lake, Cameron (in press.) later investigated abundance and species composition of arboreal gastropods at five other study sites in Nova Scotia. Non-native gastropods made up 90% of individuals found in Cameron's study.

FORESTRY

During a return visit to the Jacket Lake 2 site in September 2005, the tree on which a single thallus was known to occur had blown down. The tree was in a 30 m buffer left after an adjacent area was clearcut. We estimate the clearcut to have occurred 4 to 5 years previously. The site had been previously visited in September 2004.

An *Erioderma pedicellatum* thallus found in Blandford on November 29, 2006, was likely lost due to forestry activity. Shortly after its discovery, the adjacent forest was clearcut to within 7 m of the thallus. When the site was re-visited on August 13, 2007, the thallus was no longer present. It is unknown whether the thallus died because of microclimate changes caused by the clearcutting, removed by contact with logging equipment or other reasons. There is some evidence that a nearby red maple had fallen after the cut, possibly knocking the thallus to the ground, though no remains were visible. Notwithstanding, forestry activity seems highly likely to be the cause of this mortality.

Maas and Yetman (2002) suggest habitat loss, due in part to forestry, as part of the reason for decline of boreal felt lichen in Nova Scotia. Forestry effects on lichens have been well documented in temperate and boreal regions (Esseen et al. 1981, Kuusinen 1994, Lesica et al. 1991, Pettersson et al. 1995) including Nova Scotia (Cameron 2002). Loss of lichens from forestry activity can result in direct loss through harvesting of the phorophyte on which a lichen grows and from loss of habitat for re-colonization. Forestry activity can also impact lichens by causing changes in microclimate of adjacent forests within the landscape of forestry activities (Richardson & Cameron 2004)

NECROSIS

Necrosis appears to play a role in the decline of *Erioderma pedicellatum.* Although necrosis can be a part of natural dying in mature thalli, a number of immature thalli have been observed suffering from this condition. Necrosis can occur in mature thalli as they age. Goudie et al. (in prep.) have identified several stages, which they name necrotic, necrotic loose and necrotic regenerating. Five thalli had heavy necrosis before dying, three of which we attribute to natural aging. These three thalli occurred in two locations; one thallus at River Lake and two thalli at Maple Hill. The remaining two of the five dead thalli with heavy necrosis were relatively young thalli. These two thalli both occurred at River Live. Another four live thalli had necrosis and were located at West Cranberry, Skull Lake, and Melvin Lake.

AIR POLLUTION

One thallus at Melvin Lake was loosely attached before disappearing and three live thalli are loosely attached. Loosely attached thalli may be a factor in *Erioderma pedicellatum* mortality. W. Maass (pers. comm.) speculates that bark acidified by acid rain may affect the attachment of *E. pedicellatum,* thus causing looseness and eventually detachment. Dr. Maass has ongoing research into bark pH of various tree species in Nova Scotia and similar studies are occurring in Newfoundland (Bill Clarke pers. comm.) to determine how this might affect recruitment and survival.

Acid rain and air pollution continue to be a concern to *Erioderma pedicellatum* and may be the cause of some mortality. Despite reductions in sulphur emissions in eastern and mid-western North America, large areas of eastern Canada continue to receive levels of acid deposition in excess of critical loads (Environment Canada 2004). Critical loads are defined as the level of acid deposition above which the ecosystem can not assimilate it without significant harmful effects. Critical loads are determined from soil, geology, vegetation type, climate and wind patterns. Direct measurement of acid precipitation might provide a more accurate estimate of the potential impact on *E. pedicellatum* than critical loads, but acid precipitation data is not available for Nova Scotia. Nonetheless, since geology and soils directly affect bark pH (Gustafsson & Eriksson 1995), critical loads provide an indirect measure of potential impact. The Science Assessment from Environment Canada presents worst case and best case scenarios depending on how much nitrogen oxide deposition is considered to contribute to acid precipitation. Even in the best case scenario, southwestern Nova Scotia and southwestern New Brunswick have the highest exceedances anywhere in Canada. The eastern shore of Nova Scotia also exceeds critical loads.

CONCLUSION

Over half of the dead thalli (16 of 25) died of unknown causes. These thalli showed no necrosis, looseness or heavy grazing before disappearing. Mortality may have been so rapid (less than 12 months) that indications of decline were not observed during the return visits. It is also possible that indications of impending mortality were evident but were not observed by researchers during return visits. It is unknown whether the mortality of these 16 thalli are natural, anthropogenic or a combination of the two. Little is known about the cause of mortality of *Erioderma pedicellatum,* which impedes conservation and management of the species.

Our data suggests that *Erioderma pedicellatum* continues to decline on mainland Nova Scotia at an alarming rate. Recent finds on Cape Breton Island containing large, healthy adult thalli may provide some promise for survival in Nova Scotia (unpublished data). Our mortality observations suggest that the impact of forestry supports previous findings of Maass and Yetman (2002). Non-native gastropod grazing may be a new threat to this endangered species.

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Pyrenidium aggregatum, a new species from North America

KERRY KNUDSEN[1] & JANA KOCOURKOVÁ[2]

ABSTRACT. – *Pyrenidium aggregatum* is described from eastern North America on *Phaeophyscia* species and *Physcia atrostriata*. It is gall-forming, has shorter ascospores than *Pyrenidium actinellum* s. l., and consistently has eight ascospores per ascus.

KEYWORDS. – Lichenicolous fungi, parasymbionts.

INTRODUCTION

The lichenicolous fungus genus *Pyrenidium* Nyl. has dark brown perithecioid ascomata, pseudoparaphyses, distinct periphyses often with a bluish-green hue, and usually 3-septate dark brown ascospores with center pores (frequently visible), melanized septa, and apices hyaline to subhyaline (Hawksworth 1983, 1986; Matzer 1996; Navarro-Rosinés & Roux 2007). *Pyrenidium* is placed in the Dacampiaceae Körb. which is among the families *incertae sedis* in the Dothideomycetes (Lumbsch & Huhndorf 2007). The type of the genus is *P. actinellum* Nyl., which was described from England on *Leptogium teretiusculum* s.l. (Hawksworth 1983) and has been recognized as occurring on 21 different crustose, foliose and fruticose lichen species (Galloway 2007). *Pyrenidium actinellum* appears to be the only species in the family that is not host specific (Halıcı & Hawksworth 2008) and is thus almost certainly heterogeneous. The genus is comprised of seven species (Robert et al. 2005) including *P. cryptotheciae* Matzer (Matzer 1996), *P. hetairizans* (Leight.) D. Hawksw. (Hawksworth 1986), *P. hyalosporum* Alstrup, D. Hawksw. & R. Sant. (Alstrup & Hawksworth 1990), *P. santessonii* Lücking (Lücking 1998), *P. sporopodiorum* Matzer (Matzer 1996), and *P. zamiae* (Müll. Arg.) Matzer (Matzer 1996). The genus is currently in revision by Navarro-Rosinés and Roux. They are expected to transfer *Leptosphaeria crozalsii* Vouaux to *Pyrenidium* (Matzer 1996), segregate some taxa from *P. actinellum,* and transfer *P. hyalosporum* to a new genus (Navarro-Rosinés & C. Roux 2007).

In this paper we describe a new species of *Pyrenidium* from North America on *Phaeophyscia adiastola* (Essl.) Essl., *P. rubropulchra* (Degel.) Essl. (Arkansas, Kentucky, Missouri, Pennsylvania, and South Carolina), and *Physcia atrostriata* Moberg (Florida). It is characterized by consistently smaller ascospores than the currently accepted range for *P. actinellum* s.l. (Triebel 1989; Navarro-Rosinés & Roux 2007), consistently having 8 ascospores per ascus and being gall-forming.

METHODS

Specimens were examined using standard microscopical techniques. Hand-made sections were studied in water and 10% KOH [K]. All measurements were made on material mounted in water. Amyloid reactions were tested in Lugol's iodine [I] with and without pre-treatment with 5% KOH [K/I]. Ascospore and asci measurements were made with an accuracy of 0.5 µm and given in the form "(minimum–) mean minus standard deviation–mean–mean plus standard deviation (–maximum)" and followed by the number of measurements (n); the length/breadth ratio of ascospores is indicated as l/b and given in the same way. Images of the infection were captured using an Olympus DP20 digital camera using Microsuite Special Edition.

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The New Species

Pyrenidium aggregatum K. Knudsen & Kocourk. sp. nov.

Mycobank #518068.

Similis *Pyrenidio actinello* differt ascosporis (15-)16.1-*17.8*-19.5(-21) x (6.5-)6.7-*7.3*-7.8(-8.5) µm et gallas formanti.

TYPE: **U.S.A. PENNSYLVANIA.** LYCOMING CO.: Tiadaghton State Forest, N-facing slopes above S shore of unnamed tributary to Francis Branch of Slate Run, along Francis Rd., 41°32’50”N 77°32’55”W, 1000 ft, on *Phaeophyscia rubropulchra* on *Acer,* 15.v.2009, *J.C. Lendemer 17222* (NY, holotype; UCR, UGDA, hb. Kocourková, isotypes)

Description. – *Galls* convex, up to 1 mm wide, concolorous with or paler than host thallus, containing numerous ascomata, not becoming necrotic. *Vegetative hyphae*, light brown, 1-2 µm in diam., irregular and septate, cells to 7 µm long, often swollen at septa or at apices of hyphae, penetrating medulla of host, haustoria not observed, but development probably same as observed in *Pyrenidium actinellum* in *Peltigera* (de los Ríos & Grube 2000). *Ascomata* perithecioid pseudothecia 150-250 µm in diam., globose to subglobose, immersed, ostiolate, aggregated in galls. Ascomatal wall dark brown, pseudoparenchymatous of several layers, 15-25 µm thick in section, often thicker in ostiole region, cells various from globose, 4-5 µm in diameter, to elongate, 4-6 x 2-4 µm. *Hamathecium* I-, KI-. *Periphyses* with light greenish-blue tint in ostiole region, non-branching, 15-20 x 3-4 µm, 3-5 cells, 4-5 µm in length. *Paraphysoids* hyaline, 1-2.5 µm in diam., apices sometimes wider, occasionally branched. *Asci* subcyclindrical, stipitate, 8-spored, irregularly uniseriate to biseriate, 85-95 x 17-20 µm. *Ascospores* hyaline when immature in asci, becoming light to dark brown in maturity, the septa melanized a darker brown, with tips or whole end cells hyaline to subhyaline and smaller than central cells, broadly ellipsoid to broadly ovoid, rarely curved, rounded at apices, regularly 3-septate, slightly constricted or not at center septa, often with a single oil drop in two central cells, (15-)16.1-*17.8*-19.5(-21) x (6.5-)6.7-*7.3*-7.8(-8.5) µm, l/b (2.11-)2.16-*2.4*-2.7(-3.0) (n=20). *Conidiomata* pycnidia common in holotype in the very youngest warts, ± globose, ca. 75 µm in diam. *Conidia* broadly ellipsoid, ca. 3.8-4.2 x 1.8-2 µm.

Etymology. – The name refers to the aggregation of ascomata in galls on the thallus of the host.

Ecology and Substrate. – On *Phaeophyscia rubropulchra,* often on *Acer, P. adiastola* on sandstone, and on *Physcia atrostriata,* in well-established mesic forests, freshwater swampland, and in a mangrove swamp. Not pathogenic.

Distribution. – Eastern North America, from Pennsylvania to Florida. Probably sympatric with distribution of hosts, and possibly on other related species. One possible sterile specimen collected by R.C. Harris was seen from Wisconsin on *Phaeophyscia rubropulchra* (NY). *Pyrenidium actinellum* was reported on a specimen of *Phaeophyscia* from the Sonoran Desert region (Navarro-Rosinés & Roux 2007), which may be *P. aggregatum*. The report of *P. actinellum* on *Physcia caesia* (Hoffm.) Fürnr. from Minnesota may also be *P. aggregatum* (Cole & Hawksworth 2001). Hawksworth (1983) cited a specimen on *Phaeophyscia* cf. *hispidula* (Ach.) Essl. from Zambia (Africa) with ascospores 19-24 x 9-11 µm; they appear to be both longer and wider than in *P. aggregatum* and the material may represent a different taxon.

Discussion. – *Pyrenidium aggregatum* is similar to *P. actinellum* in the size of ascomata, but differs in having smaller ascospores ((15-)16.1-*17.8*-19.5(-21) x (6.5-)6.7-*7.3*-7.8(-8.5) vs. (20-)21-25(-31) x (7-)8-9(-10) µm). Hawksworth (1986) has a wider ascospore range for *P. actinellum* ((19-)20-30(-23) x 8-11(-12)). The ascospores of *P. aggregatum* occasionally overlap the lowest measurements of Hawksworth’s circumscription too, but are usually shorter and narrower. The current broad concept of *P. actinellum* includes specimens gall-forming or not, with 4 to 8 ascospores per ascus, on at least 21 hosts (Galloway 2007). *Pyrenidium aggregatum* has 8 ascospores per ascus and is consistently gall-forming on three related hosts.

Pyrenidium aggregatum differs from *P. hetairizans* growing on *Verrucaria hydrela* Ach. which has larger ascospores (24-26 x 6-9 µm) and a different unrelated host genus (Hawksworth 1986).

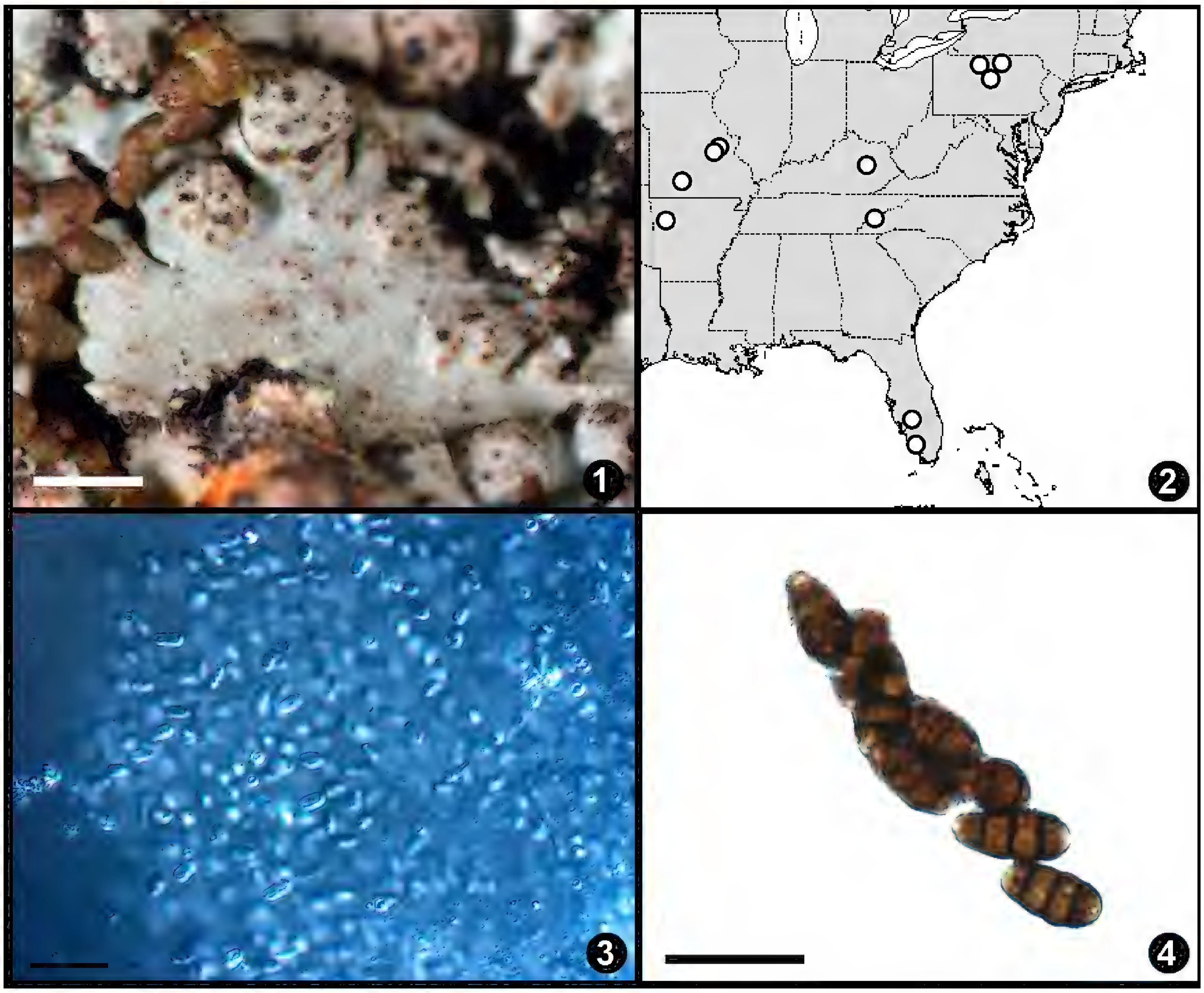

Plate 1. *Pyrenidium aggregatum* (all from holotype). Figure 1, galls of *Pyrenidium aggegratum* (scale = 0.5 mm). Figure 2, geographic distribution as presently known. Figure 3, conidia (scale = 20 µm). Figure 4, ascospores (scale = 20 µm).

Four other species of *Pyrenidium* occur on foliicolous lichens (Matzer 1996; Lücking 1998). Three of these species differ from *P. aggregatum* in having smaller ascospores on different hosts: *P. cryptotheciae* on *Cryptothecia candida* (Kremp.) R. Sant. (9-10.7-12(-13) x 4-5.0-6 µm), *P. santessonii* on *Bacidia psychotriae* (Müll. Arg.) Zahlbr. (13-15 x 4-4.5 µm), and *P. sporopodiorum* on *Sporopodium* species ((12-)13-15.8-18 x 5-5.6.-6 µm). The fourth species, *P. zamiae*, occurs on *Porina epiphylla* (Fèe) Fèe and *P. lucida* R. Sant., and is common from Jamaica and Mexico to South America. It also occurs in the Philippines. It has ascospores overlapping the size of *P. aggregatum* (15-18.0-21 x 4-4.8-5(-6) vs. (15-)16.1-*17.8*-19.5(-21) x (6.5-)6.7-*7.3*-7.8(-8.5) µm). *Pyrenidium zamiae* has narrower ascospores and differs in l/b from *P. aggregatum* (3.8 vs. (2.11-)2.16-*2.4*-2.7(-3.0); Matzer 1996). Both *P. zamiae* and *P. aggregatum* are gall-forming, but *P. zamiae* appears to suppress ascomata development of the host, making it infertile, while *P. aggregatum* is a parasymbiont.

Navarro-Rosinés and Roux (2007) have rejected the inclusion of *Pyrenidium hyalosporum* in *Pyrenidium*. Nonetheless, *P. aggregatum* has darker smaller ascospores than the hyaline ascospores of *P. hyalosporum* which are the largest in the genus (31-49 x 7.5-14 µm). *Leptosphaeria croszalsii* Vouaux from Europe, has an ascospore range (16-24 x 7-11 µm) and 4 ascospores per ascus. It is probably heterogeneous as it has been reported from two unrelated host genera, *Aspicilia* and *Caloplaca* (Clauzade et al. 1989). Since the family appears to be host specific (Halıcı & Hawksworth 2008) we doubt if *L. croszalsii* s.l. is conspecific with *P. aggregatum*, though it may include one taxon with an ascospore range similar to *P. aggregatum* but differing in 4 ascospores per ascus.

Additional Specimens examined. – **U.S.A. ARKANSAS**. FRANKLIN CO.: Ozark National Forest, Boston Mountain Ranger District, Bee Rock 35°40'24"N 93°51'45'W, on *Phaeophyscia adiastola* on sandstone, 16.iv.2004, *R.C. Harris 49286-A* (NY). **KENTUCKY**. LAKE CO.: Trace Branch Recreational Area, 37°16'32"N 83°22'06'W, c. 325m, on *P. rubropulchra,* 6.x.2001, *R.C. Harris 44985-A* (NY). **FLORIDA**. COLLIER CO.: Collier-Seminole State Park, 25°59'N 81°35'W, on *Physcia atrostriata,* 7.xii.1992, *R.C. Harris 30036-A* (NY). LEE CO.: Caloosahatchee State Park, 26°43'N 81°39'W, on *P. atrostriata,* 10.xii.1992, *W.R. Buck 23006* (NY). **MISSOURI**. CRAWFORD CO.: Blue Springs Conservation Area, 38°11'40"N 91°11'40'W, on *Phaeophyscia rubropulchra,* 28.x.2000, *W.R. Buck 38294* (NY). FRANKLIN CO.: Meramec State Park, 38°12'35"N 91°06'14'W, on *P. rubropulchra* on limestone, 23.iii.2006, *R.C. Harris 51901-A* (NY). TANEY CO.: Mark Twain National Forest, 36°47'25"N 92°43'55'W, 610 m, on *P. rubropulchra,* 19.v.2003, *W.R. Buck 44411* (NY). **NORTH CAROLINA**. HAYWOOD CO.: Great Smokey Mountains National Park, east slopes of Caldwell Peak, 35°36'20"N 83°05'30'W, 3000-3600 ft., on *P. rubropulchra* on *Acer,* 4.viii.2009, *J.C. Lendemer 18869* & *E. Tripp* (NY, poor specimen not a paratype). **PENNSYLVANIA**. BRADFORD CO.: State Games Land No. 36, Falls Creek, 41°38'25"N 76°35'50"W, c. 1400-1600 ft, on *P. rubropulchra* on *Acer,* 18.v.2009, *J.C. Lendemer 17341* (NY), *J.C. Lendemer 17326-A* (NY). LYCOMING CO.: Tiadaghton State Forest, 41°32'50"N 77°32'55"W, 1000 ft, on *P. rubropulchra* on *Acer,* 15.v.2009, *J.C. Lendemer 17204* (NY), *J.C. Lendemer 17223* (NY), *J.C. Lendemer 17231* (NY; UCR), *J.C. Lendemer 17185* (NY). UNION CO.: Bald Eagle State Park, 41° 3' 30" N 77° 04' 45" W, on *P. rubropulchra* on *Acer*, 19.x.2009, *J.C. Lendemer 19787* (NY) .

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Candelariella xanthostigmoides in North America

James C. Lendemer[1] & Martin Westberg[2]

ABSTRACT. – *Candelariella xanthostigmoides* is reported new to North America. The name is applied to what was previously referred to as *C. reflexa* in North America. The distributions of *C. xanthostigmoides* and the morphologically similar *C. efflorescens* in North America are reviewed. A lectotype is selected for *Candelaria concolor* var. *effusa* and the name is placed in synonymy with *C. concolor*.

Introduction

Species of the crustose lichen genus *Candelariella* Müll. Arg. represent a conspicuous and attractive component of the lichen biota of North America. Their bright yellow apothecia and/or thalli are instantly recognizable in the field and cannot easily be confused with any other similarly colored lichen genera (see i.e., the generic key in Brodo et al. (2001)). The genus is particularly diverse in western North America (Westberg 2004, 2007, 2007a, 2007b; Westberg & Nash 2007) and 29 species are presently recognized in the North American checklist (Esslinger 2009). Interestingly, despite the high degree of morphological and ecological diversity displayed by the North American members of the genus, only two sorediate species are known to occur in the region (Brodo et al. 2001, Harris & Buck 1978, Westberg et al. 2007). These two species have generally been referred to as *Candelariella efflorescens* R.C. Harris & Buck and *C. reflexa* (Nyl.) Lettau, and differ from each other only in the number of spores per ascus. However, in Europe, *C. reflexa* is known as a morphologically distinct species, separated from *C. efflorescens* not only by the spore number, but by its larger thallus that is sorediate from the center of the areoles.

Recently, in conjunction with his monographic studies of *Candelariella*, the second author included sequences generated from the two sorediate species in a larger dataset that was used to infer the phylogeny of the genus (Westberg et al. 2007). In this dataset *C. reflexa* was represented by three sequences representing the North American and European populations (two from Europe and one from North America), while *C. efflorescens* was represented by a single sequence that was generated from a European specimen. The results of this study indicate that *C. reflexa* is polyphyletic if circumscribed to include both North American (i.e., *C. reflexa* s.l.) and European (i.e., *C. reflexa* s.tr.) populations, and that the North American populations are more closely related to *C. efflorescens*. With this in mind we began the search for another name for the North American populations previously referred to *C. reflexa*. Review of the literature led us to the name *C. xanthostigmoides* Müll. Arg. a sorediate corticolous species from Australia (Filson 1992). Comparison of specimens of *C. xanthostigmoides* from Australia with North American material confirmed that they are morphologically similar. While we suspect that there are further taxonomic problems concerning the small sorediate species in *Candelariella* we propose that the name *C. xanthostigmoides* be used in North America for the discussed taxon.

Here we provide a description of the species, place it in the broader context of a review of the North American sorediate species of *Candelariella*, and provide a key to the sorediate species of Candelariaceae in North America (Appendix I). In conjunction with the preparation of this key we examined the type material of *Candelaria concolor* var. *effusa* Tuck., a name that has been widely misapplied to sorediate *Candelariella* specimens. A lectotype is selected for the name and it is placed in synonymy with *C. concolor* (Dicks.) Stein var. *concolor*.

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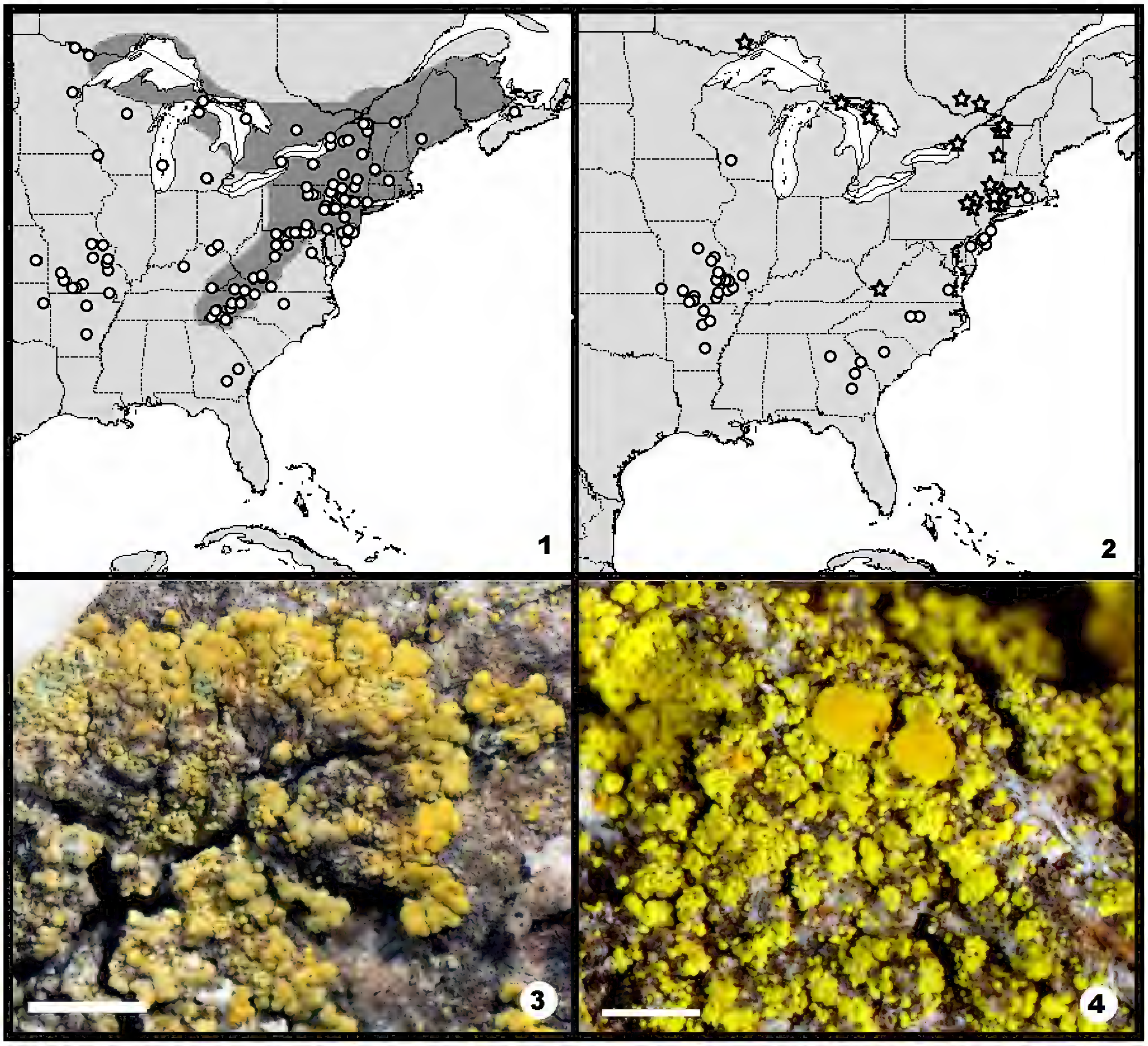

Plate 1. Figure 1, geographic distribution of sterile collections from eastern North America (hypothetical distribution of *Candelariella efflorescens* shaded). Figure 2, geographic distribution of fertile collections from eastern North America (stars = *C. efflorescens*, dots = *C. xanthostigmoides*). Figure 3, thallus of *C. reflexa* (Sweden, *Westberg s.n.* (LD), scale = 0.9 mm). Figure 4, thallus and apothecia of *C. xanthostigmoides* (*Wetmore 71864*, scale = 0.5 mm).

Materials & Methods

Specimens were studied dry using a Baush & Lomb StereoZoom 7 dissecting microscope. Microscopic characters were measured in water and images were captured using an Olympus DP20 digital camera with Microsuite Special Edition. Illustrations were prepared using Adobe Photoshop. Sections of the thallus and apothecia were cut by hand with a razor blade and mounted in water. Measurements are based on water mounts and those of the asci, ascospores, and photobiont are given as the average (xbar) +/- 1.5 standard deviations, these measurements are bounded by the extreme high and low observed values.

Results and Discussion

When Harris and Buck (1978) described *Candelariella efflorescens*, knowledge and herbarium material of North American sterile, sorediate, crustose lichens was considerably limited compared to the present day. The authors considered *C. efflorescens* to be widely distributed in eastern North America with scattered occurrences in the central and western portions of the continent. The latter reports were apparently based on sterile collections. They also noted that if *C. reflexa* (auct. Amer. = *C.*

xanthostigmoides) was present in North America it likely occurred in the western portion of the continent.

Over the three decades since the original description of *Candelariella efflorescens,* substantial material has accumulated from throughout North America, much of it collected by the authors who described the taxon. Critical revision of this material, particularly the fertile collections, has led us to revise its distribution as outlined in the section above. It also led us to expand the distribution of *C. reflexa* auct. Amer. to include much of southeastern North America. These changes in geographic distributions correspond well to the biogeographic patterns of lichens in North America outlined by Brodo et al. (2001). The correlation of 8/spored vs. polysporous fertile collections with accepted biogeographic patterns clearly indicates that sterile collections from most regions can be assigned with reasonable certainty to one species or the other. Indeed, based on the material we examined the only regions where the two taxa are sympatric are the middle-low elevations of the Appalachian Mountains, and the coastal plain from southern New Jersey and northward. This is not surprising considering that both of these regions have been documented as having overlapping floristic elements (e.g., coastal plain/piedmont species occur rarely at middle-low elevations of the southern Appalachians (Lendemer & Tripp 2008), and Appalachian/boreal species occur rarely in the northern coastal plain (Brodo 1968, Lendemer 2006, Lendemer et al. 2009).

Review of the Species

1. *Candelariella efflorescens* R.C. Harris & W.R. Buck, Michigan Bot., 17(4): 155. 1978. TYPE: **U.S.A. MICHIGAN**. MACKINAC CO.: Edge of swamp across highway from Island Point State Forest Campground (Hog Island State Forest Campground), 5.x.1974, on *Populus balsamifera*, *W.R. Buck s.n.* (MICH n.v., holotype, H!, isotype).

Description. – Detailed descriptions have been published by Harris and Buck (1978) and Westberg (2007a). These descriptions characterize well the material we have studied (cited below); however, we qualify them with the following measurements: in the specimens examined *soredia* were [18]-(21.4)-32.9-(44.5)-[57.6] µm (n=60) in diameter, *ascospores* were [8.4]-(8.3)-10.2-(12.1)-[12.1] x [3.7]-(3.9)-4.6-(5.3)-[5.8] µm (n=18), and *photobiont cells* were [6]-(8.5)-11.3-(14.2)-[14.4] in diameter.

Ecology and distribution. – *Candelariella efflorescens* occurs on the bark of both hardwoods (commonly *Acer, Fraxinus,* and *Quercus*) and conifers (*Thuja*), as well as occasionally on decorticate wood. Based on the geographic distribution of the fertile collections we examined (Plate 1, Fig. 2) the species has an Appalachian-Great Lakes distribution in the sense of Brodo et al. (2001) in eastern North America. As is typically the case in species with that distribution pattern, *C. efflorescens* also occurs in the coastal plain from southern New Jersey northward (Brodo 1968; Lendemer 2006; Lendemer et al. 2009). The occurrence of the species in Alaska indicates that it may actually occur throughout boreal North America. It is also widely distributed in temperate Europe (Westberg 2007a). Unfortunately, previously published accounts of the occurence of *C. efflorescens* in North America require verification in light of the revised distribution of *C. xanthostigmoides* (see below). It is worth noting that the frequency of fertile collections appears to decline as one moves southward in the Appalachian Mountains.

Discussion. – The ascospores of the fertile collections of *Candelariella efflorescens* we examined were consistently at the lower end of the size range reported for the species in the protologue and by Westberg (2007a). This may have been an artifact of small sample sizes (in our case n=18). It was not likely due to the age of the material as our measurements for both taxa were derived from collections made in the last decade at roughly the same time. However, it is worth noting because our measurements were consistently smaller than those we obtained for *C. xanthostigmoides*. One would expect this to be the case since the asci of *C. efflorescens* are polysporous while those of *C. xanthostigmoides* hold only eight ascospores. It is also possible that the polyspory of *C. efflorescens*, which can result in a variable number of ascospores between circa 12 and 32, is partially responsible for the large size range.

Selected Fertile Specimens Examined. – **CANADA. ONTARIO**. BRUCE CO.: Bruce Peninsula National Park, 19.ix.2008, on *Thuja*, *J.C. Lendemer 14134* (NY). GATINEAU CO.: 2.5 mi S of Poltimore, 30.v.1973, on *Amalanchier*, *I.M. Brodo et al. 19165* (CANL). THUNDER BAY DISTRICT: Cambly Farm, 25.vi.1986, on *Populus*, *C.E. Garton 23309* (NY). **YUKON:** Herschel Island, 23.vii.1972, on wood in tundra communities, *G.W. Scotter 19064* (CANL). **QUEBEC**. PAPINEAU CO.: Lac Clair, 7.vii.1986, on bark, *I.M. Brodo et al. 25289* (CANL). **U.S.A. ALASKA**. Kenai (AQ) Quad., Chisik Island, 28.vi.1987, on *Alnus, S. Talbot 128-A* (NY). **CONNECTICUT**.

LITCHFIELD CO.: Town of Norfolk, Holleran Swamp Preserve, 20.iv.2003, on *Ulmus*, *R.C. Harris 48055* (NY). WINDHAM CO.: Town of Ashford, Yale Forest, 24.vii.2002, on *Carya*, *R.C. Harris 46087* (NY). **MICHIGAN**. CHEBOYGAN CO.: SW of UMBS, 10.vii.1974, on *Populus*, *W.R. Buck s.n.* (NY). CHIPPEWA CO.: Drummond Island, 16.vii.2002, on *Thuja*, *W.R. Buck 42118* (NY). **NEW YORK**. CLINTON CO.: Town of Altona, Altona Flat Rock Area, 19.x.1996, on dead *Quercus*, *R.C. Harris 39094* (NY); Town of Beekmantown, Point Au Roche State Park, 17.x.1996, on bark, *W.R. Buck 30765* (NY); Town of Champlain, 18.x.1996, on *Fraxinus*, *W.R. Buck 30796* (NY). DUTCHESS CO.: Roger Perry Memorial Preserve, 27.v.2007, on wood, *J.C. Lendemer 12031* (NY). ESSEX CO.: Schroon Town, 9.vi.1988, on *Thuja*, *R. Dirig L2196* (NY). GREENE CO.: Catskill Park, Blackhead Range Trail, 13.v.1996, on bark, *W.R. Buck 30199* (NY). JEFFERSON CO.: Wellesley Island State Park, 19.ix.1983, on *Fraxinus*, *R.C. Harris 16674* (NY). SCHUYLER CO.: Pre-emption Rd. at West Hill Rd., 18.viii.1962, on *Quercus alba*, *C.F. Reed 60218* (NY). PUTNAM CO.: Town of Patterson, Ice Pond Conservation Area, 22.iii.2009, on *Acer saccharum*, *R.C. Harris 55094* (NY); along Peekskill Hollow Rd., 10.viii.1998, on dead elm, *W.R. Buck 34477* (NY). ROCKLAND CO.: Harriman State Park, 9.iii.2008, on *Quercus*, *J.C. Lendemer 11526* (NY). **PENNSYLVANIA**. CARBON CO.: Hickory Run State Park, Boulder Field, 5.vii.2008, on *Acer*, *J.C. Lendemer 12580* (NY); Hickory Run State Park, above Lehigh River, 19.v.2009, on *Populus*, *J.C. Lendemer 17510* (NY). LACKAWANNA CO.: State Game Lands No. 300, 3.vii.2008, on *Quercus*, *J.C. Lendemer 12418* (NY). WYOMING CO.: State Game Lands No. 57, 19.vii.2008, on *Acer*, *J.C. Lendemer 17510* (NY). **VIRGINIA**. BLAND CO.: Rt. 42, at Ceres, 17.vi.1964, on *Quercus*, *C.F. Reed 66945* (NY).

2. *Candelariella xanthostigmoides* (Müll. Arg.) R.W. Rogers, Muelleria, 5(1):32. 1982.

Lecanora xanthostigmoides Müll. Arg., Flora, 65: 484. 1882. TYPE: **AUSTRALIA.** New South Wales: Parramatta, *W. Woolls* (G, lectotype, not seen, Rogers 1982, p. 32)
Candelaria xanthostigmoides (Müll. Arg.) Müll. Arg., Bull. Herb. Boiss., 1: 33. 1892.
Placodium xanthostigmoides (Müll. Arg.) Gyeln., Rev. Bry. et Lichenol., 6: 205. 1933.

Syn. *Candelariella reflexa* auct. Amer.

Description. – This species typically has minute, flat, areoles (~0.07-0.2 mm in diameter) that are often indistinct and dissolved into soredia. The soralia appear to begin at the margin, spreading inward. The apothecia are small and lecanorine with a thin margin. A description was published by Filson (1992) which adequately describes the material we have examined. We qualify this description with the following measurements based on specimens from both Australia and North America: the *soredia* were [20]-(18.6)-32.4-(46.2)-[60] µm (n=70) in diameter, *ascospores* were [11]-(11.2)-13.3-(15.4)-[17.7] x [3.8]-(4.2)-5.0-(5.9)-[7.2] µm (n=52), and *photobiont cells* were [8.4]-(8.6)-10.4-(12.1)-[12.2] µm (n=40) in diameter.

Ecology and distribution. – In North America *Candelariella xanthostigmoides* is most frequently found on the bark and branches of deciduous trees. Only a handful of the collections we examined were from coniferous substrates (*Juniperus* and *Pinus*) or wood, and one saxicolous collection was seen. Based on the fertile collections we have examined, the distribution of *C. xanthostigmoides* in North America is centered in the Ozark Ecoregion, coastal plain, and piedmont of southeastern North America, with disjunct populations throughout western North America (although the latter cannot be confirmed based on the specimens we examined because only one fertile collection from that region was seen). In eastern North America the species becomes less common and strictly coastal as one travels northward.

Discussion. – The two relevant names available in the literature concerning this species are *Candelariella sorediosa* Poelt & Reddi and *C. xanthostigmoides*. The latter appears to match the North American specimens in all respects. *Candelariella sorediosa* is a corticolous species which was described from Nepal by Poelt & Reddi (1969). The holotype (*Poelt L434*, M!) is very meager, comprising one half of an apothecium and a few, minute areoles that are slightly raised from the substrate and sorediate from the margin. The ascospore size given in the protologue is 15–17.5 x 6–7.5 µm which is at the larger end of the size range we observed in the Australian and North American specimens. We can not, however, say that *C. sorediosa* is a distinct species based on the material at hand.

We have also investigated some fertile sorediate corticolous *Candelariella* specimens from Africa and Europe, however with inconclusive results. Two specimens from Mainz, Germany appear morphologically different from *C. xanthostigmoides* in having fairly large, up to 0.4 mm wide, adnate areoles that are distinctly sorediate at the margin. The areoles appear to become slightly raised from the substrate as the soralia develop. The ascospores measure circa 12–16 x 5–6 µm and fall within the range of variation we observed in *C. xanthostigmoides*. Two specimens from South Africa that we examined were morphologically similar to *C. xanthostigmoides* but one of the specimens had considerably larger ascospores, approximately 14.5–18 x 5–6 µm, similar in size to those reported in *C. sorediosa* (Poelt & Reddi 1969), while the other had ascospores circa 12–16 x 4–5.5 µm.

We suspect that analysis of molecular data drawn from a geographically broad sampling of 8-spored sorediate corticolous *Candelariella* populations will reveal that there are different taxa involved. Such a study is not, however, feasible at this time in large part because of the paucity of recently collected fertile specimens. Thus, at this time we cannot provide a complete revision of the sorediate *Candelariella* species. Nevertheless, it seems clear that, based on the specimens examined, the North American populations previously referred to *C. reflexa*, are conspecific with *C. xanthostigmoides*.

Candelariella reflexa is morphologically distinct from all the samples discussed above. When well-developed it has an almost rosette-like thallus (Plate 1, Fig. 3) and although this appearance is normally less pronounced it always has lobate areoles with laminal somewhat excavate soralia. As far as we know it is a European species with no confirmed occurrences in other parts of the world.

Selected Fertile Specimens Examined. – **AUSTRALIA. AUSTRALIAN CAPITAL TERRITORY:** *H. Streimann 5151* (H), *W.A. Weber & D. McVean L-47380* (H). **NEW SOUTH WALES:** *D. Frödén 1205* (LD), *W.A. Weber & D. McVean L-48893* (H), *H. Streimann 9789* (H). **QUEENSLAND:** *J.A. Elix 35043* (H). **WESTERN AUSTRALIA:** *I. Kärnefelt 971704* (LD). *C.M. Wetmore 78137* (S). *C.M. Wetmore 78164* (S). **U.S.A. ARKANSAS**. CLEBURNE CO.: Cherokee Wildlife Management Area, along Miller Point Rd. N, 29.iii.2006, on *Carya*, *R.C. Harris 52315* (NY). INDEPENDENCE CO.: Cherokee Wildlife Management Area, 0.3 mi E of Banner Look, 29.iii.2006, on *Ulmus alata*, *R.C. Harris 52355* (NY). IZARD CO.: Calico Rock, 26.iv.1988, on bark, *R.C. Harris 21658* (NY). JEFFERSON CO.: Pine Bluff Arsenal, 2.xii.1999, on *Quercus*, *D. Ladd 1999* (NY). **CALIFORNIA**. SAN BERNARDINO CO.: San Bernardino Mountains, Alpine Meadow, 14.vi.2004, on decaying conifer wood, *K. Knudsen 1247* (NY). **CONNECTICUT.** WINDHAM CO.: Mansfield Hollow State Park, 29.vii.2002, on *Q. velutina*, *F. Bungartz & F. Ziemmeck 3002* (hb Bungartz). **GEORGIA**. COLUMBIA CO.: Heggie's Rock Preserve, 6.x.1999, on bark, *R.C. Harris 43501* (NY). DEKALB CO.: Stone Mountain Park, 28.ii.2007, on *Cornus*, *S.Q. Beeching 2394* (NY). WASHINGTON CO.: ca. 3 mi N of Harrison, 18.iii.1995, on *Quercus*, *R.C. Harris 36277* (NY). WHEELER CO.: along US 411 at CR 148, 19.ix.1996, on *Quercus*, *W.R. Buck 30585-A* (NY). **ILLINOIS**. RANDOLPH CO.: Piney Creek Ravine Nature Preserve, 7.xi.2004, on *Fraxinus*, *R.C. Harris 50594* (NY). **KANSAS**. CHEROKEE CO.: ca. ¼ mi W of KS 7, 13.iv.2004, on bark, *R.C. Harris 48894* (NY). **KENTUCKY**. NELSON CO.: Bernheim Arboretum, 23.x.2002, on *Fraxinus*, *D. Ladd 24002* (hb. Ladd). **MISSOURI**. BENTON CO.: Rock Hill Prairie, 24.xi.1992, on dead shrub, *D. Ladd 16839* (CANL). CRAWFORD CO.: Onondaga Cave State Park, 2.xi.2004, on bark, *W.R. Buck 47424* (NY). DENT CO.: Indian Trail Conservation Area, 3.xi.2004, on bark, *W.R. Buck 47431* (NY). GREENE CO.: Wilson's Creek National Battlefield, 29.x.2000, on *Quercus*, *R.C. Harris 44152-A* (NY). IRON CO.: St. Francis Mountains, Clark National Forest, 13.x.1993, on *Ulmus alata*, *R.C. Harris 31137* (NY). MONTGOMERY CO.: Grand Bluffs Conservation Area, 27.x.2001, on bark, *W.R. Buck 40623* (NY). OREGON CO.: Mark Twain National Forest, Falling Spring, 17.iv.1997, on bark, *W.R. Buck 31885* (NY). OZARK CO.: Mark Twain National Forest, Smoke Tree Scenic Lookout, 11.x.1997, on *Fraxinus*, *R.C. Harris 41387* (NY). RANDOLPH CO.: Rudolf Bennitt Conservation Area, 14.iv.2005, on *Prunus*, *R.C. Harris 50683* (NY). SHANNON CO.: Ozark National Scenic Riverways, 24.iv. 1990, on *Ulmus alata*, *R.C. Harris 25732* (NY). TANEY CO.: Mark Twain National Forest, Hercules Glade, 20.v. 2003, on bark, *W.R. Buck 44501* (NY). WASHINGTON CO.: Hughes Mountain Conservation Area, 3.xi.2002, on branch, *A. Amtoft 337-A* (NY). WAYNE CO.: Coldwater Conservation Area, 22.x.2001, on *Quercus*, *W.R. Buck 40079* (NY). **NEW JERSEY**. ATLANTIC CO.: Nature Conservancy Reserve, SE of Egg Harbor City, 21.x.2003, on *Quercus*, *J.C. Lendemer 1470* (NY). BURLINGTON CO.: Wharton State Forest, ~3 mi NE of Atsion, 4.i.2004, on *Quercus*, *J.C. Lendemer 1764* (NY); Lebanon State Forest, 13.x.1994, on bark, *S.D. Sharnoff & S. Sharnoff 1511.22* (CANL). CAMDEN CO.: Wharton State Forest, 0-0.5 mi W of CR536, 6.ii.2009, on *Quercus*, *J.C. Lendemer 15473* (NY). CUMBERLAND CO.: Vineland Township, E side of NJ 55 just N of NJ56, 9.iv.2000, on *Quercus*, *W.R. Buck 36843* (NY). MONMOUTH CO.: Allaire State Park, 5.ii.2009, on *Quercus*, *J.C. Lendemer 15425* (NY). **NORTH CAROLINA**. ORANGE CO.: Mason Farm Biological Reserve, 3.v.2007, on hardwood, *G.B. Perlmutter 947* (NY). WAKE CO.: Laurel Hills Park, 28.xii.2007, on *Quercus phellos*, *G.B. Perlmutter 1239* (NY). **OKLAHOMA**. OSAGE CO.: Tallgrass Prairie Preserve, 19.iv.2006, on *Cercis*, *D. Ladd 28113* (hb. Ladd). **SOUTH CAROLINA**. RICHLAND CO.: Fort Jackson Army Base, 13.iii.1997, on *Quercus*, *R.C. Harris 40000* (NY). **VIRGINIA**. WILLIAMSBURG CITY: College of William & Mary, 20.ii.2004, on *Crataegus*, *B.P. Hodkinson 88* (NY). **WISCONSIN**. RICHLAND CO.: ½ mi SE of Hub City, 16.viii.1974, on *Pinus strobes*, *M. Nee 13557* (NY).

Additional fertile specimens (*Candelariella* spp.) examined. – **GERMANY.** RHEINLAND-PFALZ. Mainz, Alte Ziegelei, ix.2001, *E. Westberg* (LD). Mainz Botanical Garden, 16.vi.2003, *E. Westberg* (LD). **SOUTH AFRICA.** TRANSVAAL. *Almborn & Kärnefelt 8490-55* (LD). CAPE PROVINCE. *Almborn 5430* (LD).

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APPENDIX I - KEY TO THE SOREDIATE CANDELARIACEAE IN NORTH AMERICA

We have included a key to the sorediate Candelariaceae in North America in large part to reflect the changes in geographic distribution introduced here. It is hoped that collectors will turn up additional fertile collections that will better elucidate the boundaries of the distributions (and areas of sympatry) of *Candelariella efflorescens* and *C. xanthostigmoides*. We have also compiled this key with the goal of better illustrating the differences between sorediate *Candelaria* and *Candelariella* species, as well as the lookalike granulose species *Candelariella xanthostigma* (Mull. Arg.) Zahlbr. We hope this will finally eliminate the use of the name *Candelaria concolor* var. *effusa*, whose taxonomic status has been resolved here and which has been widely misapplied to specimens of *Candelariella* in the past.

1. Thallus foliose, although sometimes mostly dissolved into soredia with only a few intact lobes remaining…………………………………………………………………………………………………....2
    2. Asci polysporous; soredia produced marginally; widespread throughout the continent……………. ………………………………………………………………………*Candelaria concolor* (Dicks.) Stein
    2. Asci 8-spored; soredia produced on the lower surface of the thallus; coastal southwest with occasional inland localities……………………… *Candelaria pacifica* M. Westb. & Arup (in press)
1. Thallus crustose……………………………………………………………………………………….....3
    3. On mosses and plant remains on the ground in arctic-alpine habitats.. …………………………………………………………*Candelariella granuliformis* M. Westb. ined.
    3. On bark or wood in other habitats………………………………………………………………....4
        4. Asci 8-spored; widespread except in the Great Lakes-Appalachian Mountains............................ ……………………………………………………………………..*Candelariella xanthostigmoides*
        4. Asci polysporous; distribution various………………………………………………………...5
            5. Soredia small, 20-40-(50) µm in diameter, true soredia arising from the breakdown of thalline areoles; Appalachian-Great Lakes……………………....*Candelariella efflorescens*
            5. Soredia large, 50-100 µm in diameter, “soredia” actually granules that form the primary thalline units; widespread…………………………….....…......*Candelarella xanthostigma*

APPENDIX II – DISPOSAL OF THE NAME *CANDELARIA CONCOLOR* VAR. *EFFUSA*

In North America the name *Candelaria concolor* var. *effusa* has historically been used for forms of *Candelaria concolor* in which the thallus has almost completely dissolved into soredia (e.g., Brodo 1968). During our study we became curious about the application of the name *Candelaria concolor* var. *effusa* Tuck., because the above usage is not consistent with the protologue (Tuckerman 1882). Apparently Tuckerman lumped the taxa we currently recognize as *C. concolor* and *C. fibrosa* (Fr.) Müll. Arg. into his concept of *C. concolor* (using the name *Teloschistes concolor* (Dicks.) Tuck.), treating the fertile morph (= *C. fibrosa*) as *T. concolor* var. *concolor* and the sorediate morph (= *C. concolor*) as *T. concolor* var. *effusa*. Examination of the syntypes of the latter name confirmed that it represents the typical undissolved form of *C. concolor*. Thus we select a lectotype below and place the name in synonymy with *C. concolor* var. *concolor*. We do not consider the dissolved form of *C. concolor* to have any taxonomic merit and suggest that all such specimens be treated as *C. concolor* s. str.

Candelaria concolor (Dicks.) Stein *in* Cohn [var. *concolor*], Kryptog. Flora von Schlesien, 2: 84. 1879.

Syn. nov. *Teloschistes concolor* b. *effuse* [sic] Tuck., Syn. N. Amer. Lich., 1: 52. 1882. TYPE: CUBA: sine loc, sine date, *C. Wright s.n. = Lich. Cub. 79* (FH-TUCK #580 [HUH BARCODE-197767] thallus marked “b”, lectotype **selected here**).
Candelaria concolor [unranked] *effusa* (Tuck.) G. Merr. & Burnh., Bryologist, 25: 73. 1922.

Typificational Note. – The protologue of *T. concolor* var. *effuse* includes direct reference to only two collections, one made by Hale in Louisiana, USA and the other distributed by Wright as *Lichenes Cubae 79*. Representatives of both collections (cited below) were found in the Tuckerman Herbarium at FH, however only the packet and thallus selected as the lectotype are marked with the letter “b” in Tuckerman’s hand. The two Tuckerman specimens, as well as a duplicate of *Lichenes Cubae 79* from the general herbarium at FH, represent the typical form of *Candelaria concolor*. We selected the above specimen as the lectotype because it is the only one that has a direct reference to Tuckerman’s infraspecific taxon “b” in his own hand.

Additional syntypes examined. – **CUBA**: sine loc., sine date, *C. Wright s.n. = Lich. Cub. 79* (FH [HUH-BARCODE 197765]. **U.S.A. LOUISIANA:** sine loc., 1851-1853, *Hale s.n.* (FH-TUCK #538 [HUH-BARCODE 197766]).

Opuscula Philolichenum, **8**: 83-100. 2010.

Lichens, Lichenicolous and Allied Fungi of the Santa Monica Mountains, Part 5: Additions and Corrections to the Annotated Checklist

KERRY KNUDSEN[1] & JANA KOCOURKOVÁ[2]

ABSTRACT. – Fourteen fungi (6 lichens and 8 lichenicolous fungi) are newly reported for the Santa Monica Mountains. *Endococcus rugulosus* s. str. is reported as new for North America (a previous report from North America represents another taxon). *Athelia arachnoidea*, *Merismatium decolorans,* and *Sphaerellothecium cladoniae* are newly reported for California. *Ramonia ablephora,* previously only known in the mountain range from historical records, was re-discovered and is rare. Three hundred and eleven taxa (271 lichens, 36 lichenicolous fungi, and 4 allied fungi) have been reported from our surveys in the beginning of the 21st century. Seventy-five taxa not collected since 1915 are discussed (67 lichens, 2 lichenicolous fungi, 7 allied fungi), increasing the number of taxa not collected since 1915 to 94 (83 lichens, 3 lichenicolous fungi, 8 allied fungi). Combining new reports and historical records of taxa not collected since 1915, a total of 405 taxa have been reported in current series of papers from the Santa Monica Mountains (354 lichens, 39 lichenicolous fungi, and 12 allied fungi).

KEYWORDS. – Biodiversity, California, extirpation, H.E. Hasse, rare species, urbanization.

INTRODUCTION

This paper represents the fifth part in a floristic study of the Santa Monica Mountains (Knudsen 2005 & 2007a; Knudsen et al. 2008; Knudsen & Kocourková 2009b). It is comprised of additions to the official annotated checklist published in 2007 which is maintained and revised annually for the National Park Service.

Throughout this paper we discuss the collections of H.E. Hasse whose specimens, taken during the early 20th century, form the historical baseline of our checklist. Although Hasse's collection and identification methods are the subject of another publication in this volume we provide several notes below to aid readers (Knudsen 2010). In this paper we often mention Hasse's original determinations especially in the historical section. Hasse collections should not be annotated based on these revisions without checking the specimens individually. Hasse's species concepts changed over time. In other cases, such as *Verrucaria* for instance, he often had no clear species concepts and several taxa may have been identified as the same species. This is in addition to the routine mistakes of determination that crop up in anyone's career and herbarium. It is also important to recognize that his exsiccati sets were put together after his death. It is not uncommon to find several taxa distributed under a single name and number in his exsiccati. Hasse had no collection numbers and kept specimens under lot numbers which he assumed contained all the same taxon (see Knudsen 2010). Hasse's specimens often lack specific information on where in the Santa Monica Mountains he collected them. Often they lack dates, sometimes even the year.

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MATERIALS & METHODS

The methods in this paper follow those of previous installments of the series (see Knudsen 2007a). In some reports only selected specimens are cited, if possible one from each of the two counties which encompass the Santa Monica Mountains. Species published by Hasse based on Nylander's or Stizenberg's notes are consistently attributed to Hasse as "Nyl. ex Hasse" or "Stizenb. ex Hasse" (see Knudsen & Lendemer 2006). More information on most individual specimens and other collections from the Santa Monica Mountains is available online at the UCR Lichen Hebrarium website (http://sanders5.ucr.edu/lichensflat_index.php) or the Consortium of North American Lichen Herbaria (http://symbiota.org/nalichens/collections/index.php). Only a small part of Hasse's herbarium has been databased at the Farlow Herbarium (FH) at Harvard University and is available online at

(http://asaweb.huh.harvard.edu:8080/databases/specimen_index.html, enter H. E. Hasse for collector).

The first author spent two weeks in October 2009 at the Farlow Herbarium revising Hasse collections. This was supplemented by a review of pertinent literature by lichenologists. Reports in the literature by recognized experts in particular genera such as Breuss (Verrucariaceae), Dibben (*Pertusaria*), Sudin (*Arthonia*), Schultz (Lichinaceae), and a few others were accepted. A review of selected Hasse collections at Minnesota (MIN) was begun through a loan. We discussed some collections at New York Botanical Garden (NY) with J. C. Lendemer.

Entries are arranged alphabetically by genus and species. Lichenicolous fungi are denoted with an asterisk "*" following the name while non-lichenized fungi treated with lichens are denoted with a dagger "†".

I – NEW RECORDS

1. *Athelia arachnoidea* (Berk.) Jülich*

NOTES. – *Athelia arachnoidea* is a pathogenic basidiomycete on epiphytic and lignicolous lichens occurring widely in Europe and North America, and in Tunisia in Africa (Diederich 2004a). Our specimens formed large necrotic areas with typical white hyphae, without basidia and without sclerocia, on *Lepraria santmonicae* K. Knudsen & Elix and on *Candelaria pacifica* Westberg ined. (usually corticolous), both growing on sandstone on a north slope. We know that there are also other *Athelia* species that invade lichens, but as most lichenicolous *Athelia* collections are sterile they are usually included under *A. arachnoidea*. For this reason we refer our specimens to this species until we discover fertile specimens. It is reported new for California.

SPECIMENS EXAMINED. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Malibu Creek State Park, Bulldog Motorway, north slope on *Lepraria santamonicae* on sandstone, 34°5'22"N, 118°46'02"W, 670 m, 23.xi.2009, *J. Kocourková s.n.* w/ *K. Knudsen & T. Sagar*; same location, on *Candelaria pacifica* on sandstone, *K. Knudsen 11821 w/ J. Kocourkova & T. Sagar* (UCR).

2. *Echinodiscus lesdainii* (Vouaux) Etayo & Diederich*

NOTES. – Recently reported new for North America (Kocourková et al. 2010) on *Lecania cyrtella* (Ach.) Th. Fr. In the Santa Monica Mountains, the host is common especially on *Malacothamnus fasciculatus* (Torrey & A. Gray) E. Greene.

SPECIMEN EXAMINED. – **U.S.A. CALIFORNIA**. VENTURA CO.: Point Mugu State Park, Upper La Jolla Valley, 34° 6' 37" N 119° 01' 46" W, 270 m, 13.vii.2009, on *Lecania cyrtella* growing on *Malacothamnus fasciculatus, J. Kocourková 7344 w/ K. Knudsen & T. Sagar* (hb. Kocourková).

3. *Endococcus stigma* (Körb.) Stizenb.*

NOTES. – This lichenicolous fungus is common in California especially on *Acarospora socialis* H. Magn. (Knudsen & Kocourková 2007). We observed conidia in the specimen examined to be ca. 4 x 1 µm in size.

SPECIMEN EXAMINED. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Hepatic Gulch, near Schueren Road, 34°4'44"N, 118°38'41"W, 676 m, on brown *Acarospora* species, 5.xii.2009, *J. Kocourková s.n. & K. Knudsen* (UCR).

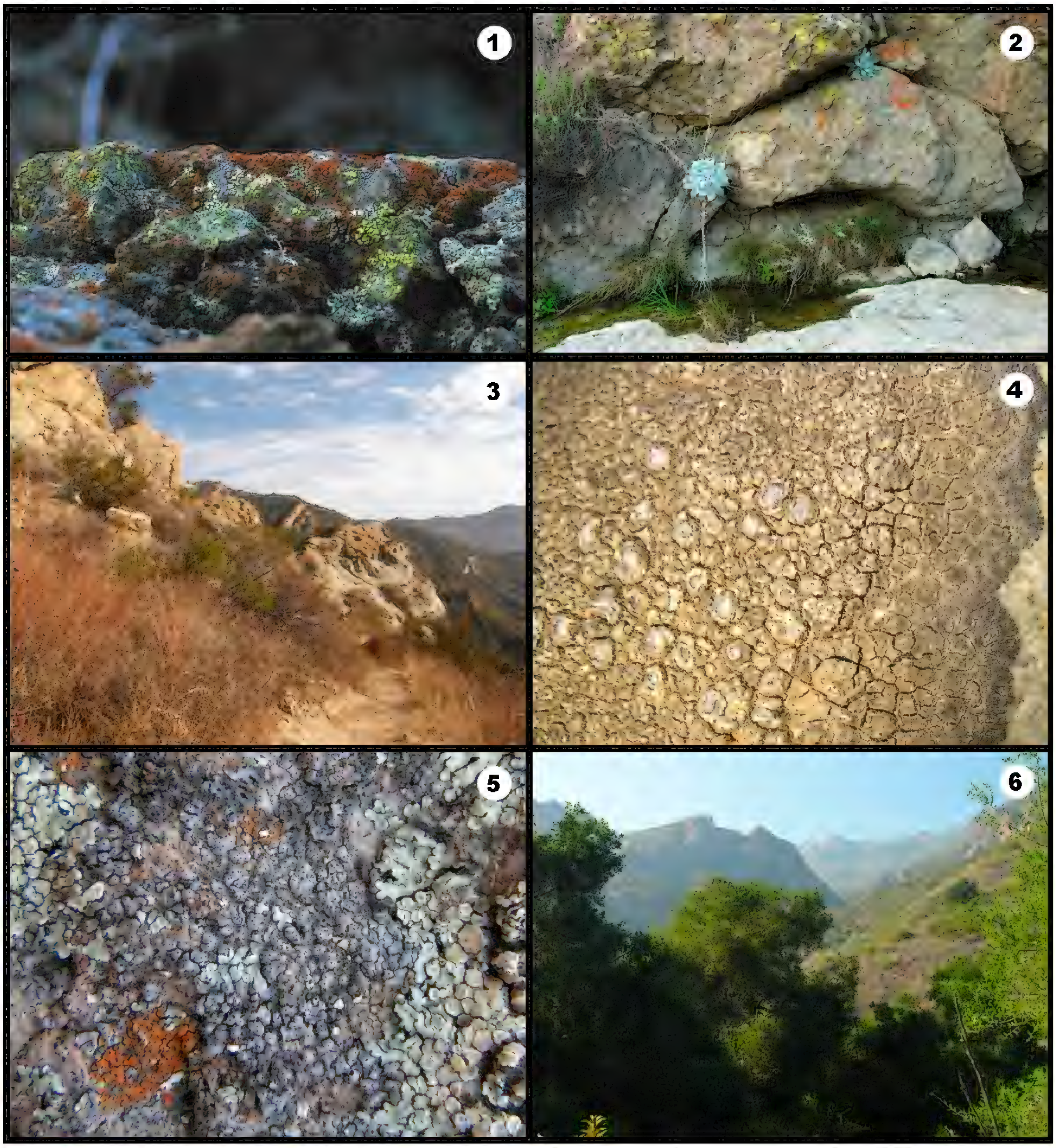

Plate 1. Lichens and lichen habitats of the Santa Monica Mountains. Figure 1, typical saxicolous community on Conejo volcanics. Figure 2, typical seasonal creek habitat. Figure 3, typical interior habitat in central part of range in Westlake area. Figure 4, *Aspicilia confusa* Owe-Larss. & A. Nordin (thallus often more scattered than illustrated). Figure 5, *Placocarpus americanus* K. Knudsen et al. Figure 6, Backbone Ridge area.

4. *Endococcus rugulosus* Nyl. s. str.*

NOTES. – *Endococcus rugulosus* s. str. has small, dark brown, verruculose ascospores and occurs on *Verrucaria* species (Sérusiaux et al. 1999; Kocourková 2000; Kocourková & Knudsen in press.). Triebel's circumscription of *E. rugulosus* is heterogeneous, characterized by smooth ascospores and occuring on numerous crustose genera (Triebel 1989). *Endococcus rugulosus* is reported as occurring in North America (Esslinger 2009), based on specimen collected on *Rhizocarpon geographicum* (L.) DC. (Sirois et al. 1988). Their report definitely refers to a different species of *Endococcus* and needs to be revised. Our collection is the first report of *E. rugulosus* s. str. from North America. The genus is obviously in need of a revision.

SPECIMEN EXAMINED. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Hepatic Gulch, near Schueren Road, 34°4'44"N, 118°38'41"W, 676 m, on *Verrucaria furfuracea*, 5.xii.2009, *J. Kocourková s.n. & K. Knudsen* (UCR, hb. Kocourková).

5. *Lichenoconium lecanorae* (Jaap) D. Hawksw.*

NOTES. – *Lichenoconium lecanorae* is known from a large range of hosts from Asia, Europe and South America, and is probably widespread but infrequently collected in North America (Diederich 2003, 2004b; Kocourková 2000). We report it new to Santa Rosa Island.

SPECIMENS EXAMINED. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Hepatic Gulch, near Schueren Road, 34°4'43"N, 118°38'43"W, 670 m, on *Xanthoparmelia* species on sandstone, 22.xi.2009, *J. Kocourková s.n. & K. Knudsen* (hb. Kocourková); SANTA BARBARA CO.: Santa Rosa Island, Channel Islands National Park, above tributary of Water Canyon, below Wreck Road, 33°58'40"N 120°2'25"W, 142 m, on *Niebla homalea* on Jana's Rock, 18.vii.2007, *J. Kocourková s.n. & K. Knudsen* (PRM 909707).

6. *Merismatium decolorans* (Rehm ex Arnold) Triebel

NOTES. – *Merismatium decolorans* is a lichenized lichenicolous fungus known from a large range of hosts from Asia (China), Europe, and North America (Canada and Greenland) (Hansen & Obermayer 1999; Hafellner & Obermayer 1995; Triebel 1989). It grows on various muscicolous and terricolous lichens. In the Santa Monica Mountains we collected it on sandstone growing between squamules of the primary thallus of *Cladonia nashii* Ahti. We report it new to California.

SPECIMEN EXAMINED. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Hepatic Gulch, near Schueren Road, 34°4'44"N, 118°38'41"W, 676 m, on sandstone, on *Cladonia nashii,* 5.xii.2009, *J. Kocourková s.n. & K. Knudsen* (UCR).

7. *Myriospora heppii* (Nägeli ex Körb.) Hue

Syn. *Acarospora aeruginosa* Hasse, Contrib. U.S. Nat. Herb., 17(1): 68. 1913. Type: **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Santa Monica Mountains, *H.E. Hasse* (FH!, holotype).

NOTES. – The species is rare in southern California (Knudsen 2007c). Both Magnusson (1929) and Knudsen (2007b) who saw specimens that Hasse identified as *Acarospora aeruginosa* recognized Hasse's species as a synonym of *Myriospora heppii.* Hasse collected the holotype of *A. aeruginosa* on sandy shale in "the foothills near the Old Soldier's Home" in the Santa Monica Mountains (Hasse 1913; this information is lacking from packet). We recently rediscovered the species on calcareous sandstone at base of a hillside on a north slope. It was growing with a few perithecia of *Thelocarpon intermediellum* Nyl. [*J. Kocourková s.n. w/ K. Knudsen & T. Sagar* (UCR)]. It is worth noting that this is only the second record of *T. intermediellum* from California and it was lichenized (Knudsen & Lumbsch 2007).

SPECIMEN EXAMINED. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Malibu Creek State Park, Bulldog Motorway, base of north slope, 34°5'12"N, 118°46'13"W, 721 m, 23.xi.2009, *J. Kocourková s.n. & K. Knudsen & T. Sagar* (hb. Kocourková).

8. *Ramonia ablephora* (Nyl. ex Hasse) R.C. Harris

NOTES. – This species was originally collected in the Santa Monica Mountains and published by Hasse in his first checklist of southern California lichens (Hasse 1898). It was omitted from his flora (Hasse 1913) probably because he had sold his only specimens to New York Botanical Garden in 1905 and could not verify it for the flora. The species was considered as a historical record from the Santa Monica Mountains (Knudsen 2007a). Recently J.C. Lendemer rediscovered *Ramonia ablephora* in the San Jacinto Mountains (Lendemer et al. 2009). It is rare and currently known from only three sites in southern California, the other two being in the Santa Monica Mountains, where we recently re-discovered it. In the field it looks similar to a *Polysporina.*

Specimens Examined. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Hepatic Gulch, near Schueren Road, 34°4'44"N, 118°38'41"W, 676 m, on sandstone, 5.xii.2009, *K. Knudsen 11839 & J. Kocourková* (UCR); Malibu Creek State Park, trail to Lost Cabin, 34°5'02"N, 118°33'33"W, 244 m, on sandstone boulder along seasonal creek, 8.x.2009, *K. Knudsen 11734 & T. Sagar* (H, UCR).

9. *Sphaerellothecium cladoniae* (Alstrup & Zhurb.) Hafellner*

Notes. – This taxon was recently reported as new for North America as *Sphaerellothecium araneosum* var. *cladoniae* Alstrup & Zhurb. (Zhurbenko & Alstrup 2004) and is still included under the varietal name in the North American checklist (Esslinger 2009) but treated as a species by Hafellner (Hafellner et al. 2005). We report *S. cladoniae* new for California on *Cladonia nashii* Ahti.

Specimen Examined. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Hepatic Gulch, near Schueren Road, 34°4'43"N, 118°38'43"W, 670 m, on *Cladonia nashii* on sandstone, 22.xi.2009, *J. Kocourková s.n. & K. Knudsen* (hb. Kocourková).

10. *Stigmidium ramalinae* (Müll. Arg.) Etayo & Diederich*

Notes. – Recently reported new for North America (Kocourková et al. 2010). The ascomata are small and easily overlooked.

Specimen Examined. – **U.S.A. CALIFORNIA**. VENTURA CO.: Point Mugu State Park, Upper La Jolla Valley, 34° 6' 37" N 119° 01' 46" W, 270 m, 13.vii.2009, on *Ramalina subleptocarpha* on *Malacothamnus fasciculatus, Kocourková 7342 & Knudsen* (hb. Kocourková).

11. *Verrucaria dacryodes* Nyl. ex Hasse

Notes. – This species is apparently endemic to the Santa Monica Mountains. This represents the first collection of *Verrucaria dacryodes* since the original Hasse collections. For a description see Breuss (2007). The ascospores are usually tear-shaped. The determination was verified by Othmar Breuss.

The genus *Verrucaria* is very diverse in the Santa Monica Mountains. We have recorded 20 species including those treated in this paper (Breuss 2007; Knudsen 2007a; Knudsen et al. 2008; Knudsen & Kocourková 2009b). Hasse only recognized nine species of *Verrucaria* in all of southern California, including the calciphile *Bagliettoa calciseda* (DC.) Gueidan & Cl. Roux (Hasse 1913).

Specimen Examined. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Malibu Creek State Park, trail to Lost Cabin, 34°5'02"N, 118°33'33"W, 244 m, on sandstone boulder along seasonal creek, 8.x.2009, verified by Othmar Breuss, *K. Knudsen 11741 & T. Sagar* (UCR, hb. Breuss).

12. *Verrucaria inornata* Servít

Notes. – Collected on a ridge where the water settles on shale after rains. Determined by Othmar Breuss. This is the second collection of *Verrucaria inornata* from California; the other specimen was collected from the concrete of an old ranch cistern in the Santa Ana Mountains in Riverside County (Breuss 2007).

Specimen Examined. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Malibu Creek State Park, Phantom Trail, ridge above Liberty Canyon, 34°7'01"N, 118°43'43"W, 401 m, 7.x.2009, det. by Othmar Breuss, *Knudsen 11719* (H, UCR, hb. Breuss).

13. *Verrucaria viridula* (Schrader) Ach.

Notes. – Relatively rare in southern California, previously known from the Santa Ana Mountains (Knudsen & Kocourková 2009c) and the Channel Islands (Breuss 2007). Hasse's concept of *Verrucaria viridula* was applied to several taxa and we have seen no evidence yet that he actually collected *V. viridula.*

Specimen Examined. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Hepatic Gulch, near Schueren Road, 34°4'43"N, 118°38'43"W, 670 m, on sandstone, 22.xi.2009, *K. Knudsen 11800* (UCR).

14. *Weddellomyces xanthoparmeliae* Calat. & Nav.-Ros.*

Notes. – We reported this lichenicolous fungus new for North America on *Xanthoparmelia mexicana* (Gyel.) Hale from the San Jacinto Mountains in southern California (Kocourková & Knudsen 2008). This is its second collection in North America.

Specimen Examined. – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Hepatic Gulch, near Schueren Road, 34°4'43"N, 118°38'43"W, 670 m, on *Xanthoparmelia* species on sandstone, 22.xi.2009, *J. Kocourková s.n. & K. Knudsen* (hb. Kocourková).

II – Historical Records

1. *Anisomeridium biforme* (Borr.) R.C. Harris

(Syn. *Arthopyrenia parvula* Zahlbr., *Trimmatothele umbellulariae* Herre)

Notes. – Two collections of this species from the Santa Monica Mountains, annotated by R.C. Harris, were found at the Farlow Herbarium. If it still occurs in the Santa Monica Mountains, it is expected to be rediscovered in riparian woodlands in moist canyon bottoms.

Specimens Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, Santa Monica Canyon, vi.1914, *H.E. Hasse* (FH); Malibu Canyon, on *Umbellularia californica,* viii.1898, (isotype of *Arthopyrenia parvula*) *H.E. Hasse 1309* (FH).

2. *Arthonia albopulverea* Nyl. †

(Syn. *Arthonia stictella* Stizenb. ex Hasse)

Notes. – This non-lichenized fungus was collected on Catalina Island on *Lonicera* species and was described as *Arthonia stictella* Stizenb. ex Hasse (Hasse 1913), but it had been previously described by Nylander. It occurs around the Mediterranean in Europe and in California in North America. Hasse collected it in the Santa Monica Mountains on the bark of a native *Cercocarpus* species, *Juglans californica* S. Watson, and near Old Soldier's Home on an unknown host (Sundin 1999). A specimen was recently collected in San Diego on the smooth bark of young branches of *Quercus agrifolia* Nee (*Knudsen 10991*, NY, UCR).

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, on *Juglans californica*, 1911, *H.E. Hasse* (FH).

3. *Arthonia granosa* B. de Lesd. †

Notes. – The only report of this non-lichenized fungus from North America is a Hasse collection from Sullivan Canyon on willow bark (Sundin 1999).

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Sullivan's Canãn, on *Salix* species (as *Arthonia hibernica*), *H.E. Hasse* (FH).

4. *Arthonia glaucella* Nyl. †

Notes. – This non-lichenized fungus was collected on grounds of the Old Soldier's Home on smooth oleander bark by Hasse in 1899 and Sundin (1999) reported collections from the Santa Monica Mountains made by Hasse on *Quercus agrifolia, Heteromeles arbutifolia* (Lindley) Roemer, and *Juglans californica*. Hasse usually determined this species as *Arthonia galactitella* Nyl. (Hasse 1913) or *A. punctiformis* Ach.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Old Soldier's Home, on oleander, 1898, *Hasse 898* (FH); Santa Monica Mountains, vii.1910, Lichenes Exsiccati 2 (as *Arthonia punctiformis*), *H.E. Hasse* (FH).

5. *Arthonia pruinascens* (Zahlbr.) Grube †

Notes. – This non-lichenized fungus was described from the Santa Monica Mountains growing on *Malacothamnus fasciculatus.* The name has been often misapplied and is known with certainty only from the type (Grube 2007).

6. *Arthonia pruinata* (Pers.) Steud. ex A. L. Sm.

Notes. – Hasse reported this lichen as *Arthonia impolita* (Hoffm.) Borr. from the Santa Monica Mountains (Hasse 1913). In the Farlow Herbarium, only one collection from the range was found on *Rhus integrifolia* (Nutt.) Brewer & S. Watson. It is the most common corticolous *Arthonia* in California.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, on *Rhus integrifolia*, 1898, *H.E. Hasse 366* (FH).

7. *Arthonia pruinosella* Nyl. ex Hasse †

Notes. – This allied fungus was described from an ornamental tree identified as *Cordia caudata* (current name of taxon unknown) and a probable ornamental *Datura* (NY) in the landscape of the Old Soldier's Home (Hasse 1913) and is currently known from a 1988 collection in Valencia, Spain, on *Nerium oleander* L. (Sundin 1999). It has not been collected in California since 1899 (Sundin 1999). Two collections from Mexico are included in the *Lichen Flora of the Greater Sonoran Desert Region* without any note on phorophytes (Grube 2007). The holotype (H-NYL 5796) was collected at the Agricultural Experimental Station in November, 1897. It is not known if the fungus is native to California or was introduced, but *Arthonia glaucella* Nyl. (see above) was collected on both non-native and native phorophytes in the Santa Monica Mountains.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Agricultural Experimental Station near Santa Monica, on *Cordia* species, 1898, *H.E. Hasse 875* (FH).

8. *Arthonia rhoidis* Zahlbr. †

Notes. – This non-lichenized fungus was described from *Malosma laurina* (Nutt.) Abrams on Catalina Island from a collection by Hasse. He also collected it in the Santa Monica Mountains on *Platanus racemosa* Nutt., *Salix lapsiolepsis* Benth., *Umbellularia californica* (Hook. & Arn.) Nutt. and *Juglans californica* (Sundin 1999).

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Canõn, on *Juglans californica*, 12.vii.1914, *H.E. Hasse* (FH).

9. *Arthopyrenia plumbaria* (Steinzb. ex Hasse) R.C. Harris †

Notes. – This non-lichenized fungus was collected on various shrubs in California (Aptroot 2002) and sometimes may be lichenized.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, xii.1899, Lichenes Exsiccati 21 [as *Porina plumbaria* (Stizenb.) Hasse], *H.E. Hasse* (FH).

10. *Bacidia corusans* S. Ekman

Notes. – This species is common on bark and twigs of shrubs on the Channel Islands. Hasse collected it on *Juglans californica* and wrote on the packet "rare".

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, on *Juglans californica*, iii.1915, (as *Bacidia suffusa*), *H.E. Hasse* (FH).

11. *Bacidia heterochroa* (Müll. Arg.) Zahlbr.

Notes. – Ekman reported this species from Hasse's collections in the Santa Monica Mountains (Ekman 1996). This species is included as an admixture in a specimen determined as *Bacidina ramea* (*q.v.*).

12. *Bacidina ramea* S. Ekman

Notes. – Ekman reported several specimens collected by Hasse in the Santa Monica Mountains (Ekman 1996). It is frequent in central California.

Specimens Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, on bark, 1909 (as *Bacidia albescens*) with *B. heterochora*, annotated by Ekman, *H.E. Hasse* (MIN); LOS ANGELES CO.: Topanga Canyon, on *Umbellularia californica,* 1.iii.1908, (as *Bacidia effusa*), annotated by Ekman, *H.E. Hasse* (MIN).

13. *Buellia maritima* (A. Massal.) Bagl.

Notes. – This maritime species is common on the Channel Islands and along the coast from San Diego south along Baja California. Hasse collected it on sandstone.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, xii.1899, Lichenes Exsiccati 4 (as *Buellia alboatra* ssp. *saxicola*), *H.E. Hasse* (FH).

14. *Candelariella lutella* (Vain.) Räsänen

Notes. – This polysporous corticolous species was not reported from southern California in the *Lichen Flora of the Greater Sonoran Desert Region* (Westberg 2004). It appears to need high annual relative humidity. We have collected it along Burma Road on Santa Rosa Island where it is rare and in Yosemite National Park on cottonwood trees along the Merced River where it is common.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, on smooth bark, 1910, *H.E. Hasse* (MIN).

15. *Catillaria glauconigrans* (Tuck.) Hasse

Notes. – Hasse's original determination was confirmed via comparison with Tuckerman's type by W.G. Farlow. The species was reported by Hasse on poison oak, *Toxicodendron diversilobum* (Torr. & A.Gray) Greene (Hasse 1913). The only specific location listed by Hasse on some labels is Sepulveda Canyon.

Selected Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, vi. 1900, *H E. Hasse* (FH).

16. *Catinaria atropurpurea* (Schaer.) Vězda & Poelt

Notes. – Hasse originally reported *Catinaria atropurpurea* from a non-native Lombardy Pine near Ballona in Los Angeles County (Hasse 1913). The collection below looks like it is on the bark of a native phorophyte.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, iv.1914, Lichenes Exsiccati 209, *H.E. Hasse* (FH).

17. *Collema bachmanianum* (Fink) Degel.

Notes. – This taxon was identified once from a Hasse collection from the Santa Monica Mountains by M. Schultz (Schultz et al. 2004). It can be easily confused with the common *Collema tenax* (Sw.) Ach., but differs in having lobulate apothecial margins and submuriform ascospores which become pale yellow or brown when mature.

18. *Collema limosum* (Ach.) Ach.

Notes. – A pioneer species of terricolous habitats, *Collema limosum* was collected by Hasse in the Santa Monica Mountains (Hasse 1913; confirmed by M. Schultz, *pers. comm.*) but has not been collected recently. It is a rare species in California currently only known from two collections by C. Bratt and K. Knudsen from central California, but on one packet sent to Merrill, Hasse wrote that it was "common".

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, *H.E. Hasse* (FH).

19. *Collema subnigrescens* Degel.

Notes. – Probably collected on *Juglans californica,* the species was apparently common at the beginning of 20th century. The specimen was determined by M. Schultz.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, iii.1909, Lichenes Exsiccati 6 (as *Collema nigrescens*), annotated by M. Schultz, *H.E. Hasse* (FH).

20. *Fuscopannaria crustacea* P.M. Jørg.

Notes. – The type specimens of this species (FH!) were collected by Herre in the Santa Cruz Mountains, where the species was probably common. Though not included in the *Lichen Flora of the Greater Sonoran Desert Region* treatment of *Fuscopannaria* (Jørgensen 2002), Jørgensen annotated one

Hasse collection from Santa Monica Mountains as *F. crustacea.* Hasse frequently collected *F. californica* (Tuck.) P.M. Jørg. Many cyanolichens become more common northwards from central California to British Columbia, but are rare in southern California.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, i.1899, Lichenes Exsiccati 17 (as *Parmeliella lepidota*), *H.E. Hasse* (FH!)

21. *Heppia lutosa* (Ach.) Nyl.

Notes. – There are two collections of *Heppia lutosa* from the Santa Monica Mountains from 1895 made by Hasse in FH, both numbered 159, and determined by C.M. Wetmore.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, on soil, 1895 (as *H. despreauxii*), *H. E. Hasse 159* (FH).

22. *Hypogymnia gracilis* McCune

Notes. – Bruce McCune annotated a Hasse collection of *Hypogymnia* from the Santa Monica Mountains as *Hypogymnia gracilis* (NY).

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, iv.1912, *H. E. Hasse* (NY).

23. *Koerberia sonomensis* (Tuck.) Henssen

Notes. – This cyanolichen grows on silicate rocks in moist conditions and the only known modern record from southern California is from the Channel Islands (Schoeninger 2002). Hasse reported it from Topanga Canyon (Hasse 1913).

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, 1909, *H.E. Hasse* (MIN).

24. *Lecanactis californica* Tuck.

Notes. – This is a common species along the coast and on the Channel Islands of southern California and Baja California in Mexico. It occurs on the bark of various shrubs and trees as well as dead cacti, though is now often reduced to small populations and has been extirpated in some areas by coastal development (Egea & Torrente 1994).

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, on *Rhus integrifolia*, 1898, *H.E. Hasse* (FH).

25. *Lecania fuscella* (Schaerer) Körb.

Notes. – The species was collected by Hasse on *Juglans californica* mixed with *Lecania crytella* (Ach.) Th. Fr. It is frequent on the Channel Islands.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, 1899, (as *Lecanora dimera*), det. by P. van den Boom, *H.E. Hasse* (FH).

26. *Lecania inundata* (Hepp ex Körb.) M. Mayrhofer

Notes. – Collected by Hasse once on a hard rock type, not sandstone or granite.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, Rustic Canyon, xi.1906, (as *Lecanora polytropa*), *H.E. Hasse* (FH).

27. *Lecania rabenhorstii* (Hepp) Arnold

Notes. – Collected by Hasse once on sandy shale; this species is infrequent in California.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, (as *Lecania arenaria*), *H.E. Hasse 4148* (FH).

28. *Lecania turicensis* var. *californica* Zahlbr.

Notes. – Hasse collected it on hard silicate rock. The varietal status is dubious.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, Santa Ynez Canyon, 1900, *H.E. Hasse 742* (FH, isotype).

29. *Lecanora crenulata* Hook ex. Smith

Notes. – *Lecanora hagenii* and *L. crenulata* can look similar in southern California and are distinguished by ascospore width. Hasse's specimen was on sandstone.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, iv.1907, Lichenes Exsiccati 240 (as *L. hagenii*), annotated by L. Śliwa, *H.E. Hasse* (FH).

30. *Lecanora subcarnea* (Lilj.) Ach.

Notes. – This is a common saxicolous species on the north Channel Islands and on the coast of Baja California, Mexico.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, 1.x.1906, Lichenes Exsiccati 217 (as *Lecanora sordida*), *H. E. Hasse* (FH).

31. *Lecidea berengeriana* (A. Massal.) Nyl.

Notes. – Hasse collected *Lecidea berengeriana* on moss on sandstone in the Santa Monica Mountains. He did not know the species and misdetermined it as a *Toninia.* The Farlow Herbarium has several Hasse collections of this species, all probably from Topanga Canyon.

Selected Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, 1895, *H. E. Hasse 348* (FH).

32. *Lecidea erythrophaea* Flörke ex Sommerf.

Notes. – Hasse collected *Lecidea erythrophaea* in the canyons of the Santa Monica Mountains, including Topanga and Rustic Canyons, where it was apparently common at beginning of 20th century on the smooth bark of willows, *Rhus* species, and *Umbellularia californica.* We found the ascospore size to be in the lower range of variation that M. Schmull has recorded from European specimens (M. Schmull, *pers. comm.*)

Selected Specimens Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, Rustic Canyon, on *Salix* sp., 1.X.1906, *H.E. Hasse* (FH).

33. *Lempholemma polyanthes* (Bernh.) Malme

Notes. – Schultz (2004) reported *Lempholemma polyanthes* from Hasse's exsiccati.

34. *Leptogium biatorinum* (Nyl.) Leight.

Notes. – One Hasse collection (ASU) from the Santa Monica Mountains was identified as *Leptogium biatorinum* by M. Schultz (Jørgensen & Nash 2004).

35. *Letharia columbiana* (Nutt.) J.W. Thomson

Notes. – We have reported *Letharia vulpina* (L.) Hue from the Santa Monica Mountains (Knudsen 2007) but Hasse's Lichenes Exsiccati 64 (FH) is a large specimen of *L. columbiana*, a montane species in southern California, usually occurring above 6000 feet. It was probably a relic of the Little Ice Age or an early cooler moister period (for a similar example see *Pseudocyphellaria anomala* Brodo & Ahti in Knudsen & Kocourková 2009b).

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, iv.1910, Lichenes Exsiccati 64 (as *L. vulpina*), *H.E. Hasse* (FH).

36. *Maronea polyphaea* H. Magn.

(Syn. *Maronea constans* var. *sublecideina* A. Zahlbr. ex Hasse)

Notes. – Hasse's specimens were collected in the area of Sherman Oaks on the bark of a *Cercocarpus* species. The specimen cited below is acid deficient (LaGreca 2006) and does not contain alectorialic acid as stated in the *Lichen Flora of the Greater Sonoran Desert Region* (Nash & Ryan 2007). It may represent a different taxon and needs further study using modern collections from the Santa Monica Mountains (Harris 2006), but so far no existing populations have been discovered.

Specimen Examined. – **U.S.A. CALIFORNIA**. VENTURA CO.: above Sherman, on *Cereocarpus parvifolius*, 1912, *H.E. Hasse 3053* (FH, isotype of *Maronea constans* var. *sublecideina* A. Zahlbr. ex Hasse).

37. *Megaspora verrucosa* (Ach.) Hafellner & V. Wirth

Notes. – This is another species of the montane element in the lichen biota of the Santa Monica Mountains and has probably been extirpated from the range.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, 1.x.1900, on bark, Lichenes Exsiccati 244 (as *Pertusaria wulfenii*), *H.E. Hasse* (FH).

38. *Massalongia microphylliza* (Nyl. ex Hasse) Henssen

Notes. – The species was described from the Santa Monica Mountains with the only modern collection made by B.D. Ryan on Catalina Island. We do not know the current location of his specimen (Nash 2002).

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, iv.1902, Lichenes Exsiccati 20, annotated by Henssen, *H.E. Hasse* (FH); Topanga Canyon, 1908, *H.E. Hasse* (FH).

39. *Niebla ceruchis* Rundel & Bowler

Notes. – This species was found as a mixture in a specimen with *Schismatomma pluriloculare* (Zahlbr.) Zahlbr. on *Rhus integrifolia.* Because *Niebla ceruchis* often occurs with *N. cephalota* (Ach.) Rundel & Bowler, which still is found in a small part of the range, this species will likely be rediscovered.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: beach near Santa Monica, on *Rhus integrifolia,* 1898, *H.E. Hasse* (FH).

40. *Opegrapha atra* Pers.

Notes. – From southern California this species was previously reported from San Miguel Island on the basis of collections made by T.H. Nash and determined by D. Ertz (Knudsen 2009).

Specimen Examined. – **U.S.A. CALIFORNIA.** Santa Monica Mountains, on *Platanus racemosa,* 1898 (as "*Opegrapha scripta* f. *victa*"), *H.E. Hasse* (MIN).

41. *Opegrapha herbarum* Mont.

Notes. – Though *Opegrapha umbellulariae* Zahlbr. was found on the smooth bark of *Umbellularia californica,* Hasse also collected *O. herbarum* on *U. californica*. *Opegrapha herbarum* is the most common *Opegrapha* species on trees and rock in central and southern California.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, on *Umbellularia californica*, 1895, (as *O. lichenoides*), *H.E. Hasse 693* (FH).

42. *Opegrapha niveoatra* (Borr.) J.R. Laundon

Notes. – This species is known from the Santa Monica Mountains from at least two collections, one by Hasse at NY on *Quercus agrifolia*, determined by J.C. Lendemer, and a collection on *Juglans californica* collected by Leighton, probably a local botanist (FH). *Opegrapha vulgata* (Ach.) Ach. is separated from *O. niveoatra* by its longer conidia (Ertz & Egea 2007). They are sympatric in California based on distributional notes supplied by Damien Ertz.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, St. Ynez Canyon, on oak, (as *Arthonia impolita chiodectonoides*), *H.E. Hasse* 863 (NY); Santa Monica Mountains, on *Juglans californica* (as *O. pulicaris*), *Leighton 404* (FH).

43. *Opegrapha umbellulariae* Zahlbr.

Notes. – This species was described from the bark of *Umbellularia californica* in the Santa Monica Mountains. It has been collected recently in Santa Barbara County by S. Tucker and verified by D. Ertz (Ertz & Egea 2007; S. Tucker, *pers. comm.*)

44. *Opegrapha vulgata* Ach.

Notes. – See *Opegrapha niveoatra* for differences with that taxon. A number of specimens at FH had no conidia and could be either species. The New York Botanical Garden has a specimen with conidia determined by J.C. Lendemer.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, Santa Monica Canyon, vi.1914, annotated by J.C. Lendemer, *H.E. Hasse* (NY).

45. *Opegrapha xerica* Torrente & Egea

Notes. – This species is widespread in the northern hemisphere and was collected by Hasse in the Santa Monica Mountains.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, vi.1914, Lichenes Exsiccati 39 (as *O. atorimalis*), *H.E. Hasse* (FH).

46. *Peltula obscurans* var. *deserticola* (Zahlbr.) Wetmore

Notes. – Hasse collected a very fine specimen of this variety on volcanic rock in Topanga Canyon. We are somewhat skeptical about the reduction of *Peltula deserticola* Zahlbr. to varietal status.

Specimens Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, vi.1913, Lichenes Exsiccati 60, annotated by C. M. Wetmore, *H.E. Hasse* (FH); Topanga Canyon, on trap rock (volcanic), 1904, annotated by C.M. Wetmore, *H.E. Hasse 3018* (FH).

47. *Peltula zahlbruckneri* (Hasse) Wetmore

Notes. – This species usually occurs on granite. One Hasse collection is from volcanic rock in Topanga Canyon.

Selected Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, Topanga Canyon, at 4 Oaks, annotated by C.M. Wetmore, *H.E. Hasse* (FH).

48. *Pertusaria chiodectonoides* Bagl. ex A. Massal.

Notes. – Reported by Dibben (1980) from Hasse collections from Rustic and Sepulveda Canyons in MICH-FINK and originally reported by Hasse as *Pertusaria nolens* Nyl. (Hasse 1913).

49. *Pertusaria lecanina* Tuck.

Notes. – This species is common on *Quercus* species and was reported by Dibben (1980) from a Hasse collection in US.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, viii.1905, Lichenes Exsiccati 18, *H.E. Hasse* (FH).

50. *Pertusaria leioplaca* DC.

(Syn. *Pertusaria leucostoma* (Bernh.) Mass.)

Notes. – Reported by Dibben (1980) from Hasse collections, one from Topanga Canyon, at LAM.

51. *Pertusaria pustulata* (Ach.) Duby

Notes. – Reported by Dibben (1980) from Hasse collections, one from Topanga Canyon, at BM, LAM, MICH.

52. *Pertusaria xanthodes* Müll. Arg.

Notes. – Reported by Dibben (1980) from Hasse collection at WIS.

53. *Phlyctis speirea* G. Merr.

Notes. – The species was reported as *Phlyctis argena* by Hasse (1913) who collected it in Rustic Canyon and at the top of Santa Ynez Canyon on smooth oak bark.

Specimens Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, head of St. Ynez Canyon, xii.1906, *H.E. Hasse* (FH); Rustic Canyon, xii.1906, *H.E. Hasse* (FH).

54. *Physcia stellaris* (L.) Nyl.

Notes. – This is another common corticolous species which is currently known only from historical records.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, vi.1906, Lichenes Exsiccati 19, *H.E. Hasse* (FH).

55. *Physconia enteroxantha* (Nyl.) Poelt

Notes. – The species has probably not been extirpated from the Santa Monica Mountains, but *Physconia isidiigera* (Zahlbr. ex Herre) Essl. predominates.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, viii.1906, Lichenes Exsiccati 68 (as *Physcia pulverulenta pityrea*), det. by T.L. Esslinger and annotated by S. La Greca, *H.E. Hasse* (FH).

56. *Physconia perisidosa* (Erichs.) Moberg

Notes. – Collected by Hasse growing on moss and identified by T.L. Esslinger.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, 1904, *H.E. Hasse* (MIN).

57. *Polychidium muscicola* (Sw.) Gray

Notes. – Hasse reported *Polychidium muscicola* on sandstone in Topanga Canyon (Hasse 1913). The species is represented by three collections at the Farlow Herbarium, none of which had specific locations in the range.

58. *Psorotichia montinii* (A. Massal.) Forss.

Notes. – This is a small species, which can be easily overlooked. Hasse's collection is on sandstone from Topanga Canyon.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, Topanga Canyon, ii.1910, (as *Pyrenopsis polycoccum*) *H.E. Hasse 1278* (FH).

59. *Rhizocarpon macrosporum* Räsänen

Notes. – *Rhizocarpon macrosporum* is common in the mountains of southern California and the collection from the Santa Monica Mountains is on granite, which is rare in the eastern portion of the range above Hollywood. Because of the substrate, it was probably rare in the range in Hasse's period, and, like *Lecidea cinerata* Zahlbr. (Knudsen 2007), may have been extirpated by development. *Rhizocarpon macrosporum* is part of the montane element of the lichen biota of the Santa Monica Mountains.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, iv.1899, Lichenes Exsiccati 72 (as *Rhizocarpon geographicum*), *H.E. Hasse* (FH).

60. *Schismatomma pluriloculare* (Zahlbr.) Zahlbr.

Notes. – No undisturbed habitat exists on the beaches west of the city of Santa Monica along base of the Santa Monica Mountains. The area has been transformed by roads, houses, businesses, and even landslides. We suspect the cited specimen was collected in this area on *Rhus integrifolia,* a common shrub on the coast.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: beach near Santa Monica, on *Rhus integrifolia* with *Niebla ceruchis*, 1898, *H.E. Hasse* (FH).

61. *Schismatomma rediunta* (Hasse) Tehler

Notes. – In his revision of *Schismatomma*, Tehler (1993) examined five specimens from the Santa Monica Mountains collected by Hasse on *Juglans californica* (FH, US) and on *Umbellularia californica*, one from Santa Ynez Canyon (FH).

62. *Scoliciosporum umbrinum* (Ach.) Arnold

Notes. – Hasse collected *Scoliciosporum umbrinum* on sandstone. It is infrequent in southern California, but is expected to be rediscovered in the range.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, vi.1909, Lichenes Exsiccati 232, *H.E. Hasse* (FH).

63. *Sigridea californica* (Tuck.) Tehler

(Syn. *Dirina hassei* Zahlbr., *Schismatomma californicum* (Tuck.) Zahlbr.)

Notes. – Under both of the above synonyms, Hasse reported this species as "sparingly on *Quercus agrifolia*" and on *Malosma laurina* near the beach in the Santa Monica Mountains (Hasse 1913). The species is frequent along the coast and on the Channel Islands and is one of few lichens regularly found on *Eucalyptus* trees.

64. *Solenopsora crenata* (Herre) Zahlbr.

Notes. – Hasse reported *Solenopsora candicans* (Dickson) J. Steiner from Catalina Island on calcareous rock and from the Santa Monica Mountains on trap rock, i.e. volcanic rock (Hasse 1913). It is possible the Santa Monica Mountain collections were *S. crenata* (Herre) Zahlbr. which is more common in central California and on the Channel Islands. No specimens were found at FH.

65. *Sphinctrina turbinata* (Pers. ex Fr.) De Not.*

Notes. – Hasse collected *Sphinctrina turbinata* on a *Pertusaria* species on *Quercus agrifolia* but misdetermined the specimen as *S. microcephala* Nyl. Hasse (1913) reported *S. turbinata* only on a *Thelomma* species from Ballona Bluffs along Ballona Creek, a site that has been disturbed and which was the type locality of *Lecidea hassei* Zahlbr. and *Lecania fructigena* Zahlbr. This specimen is in FH and his identification was correct: *S. turbinata* occurring on a totally unexpected host. It is possible that the *Thelomma* was growing with one of the saxicolous *Pertusaria* species and *S. turbinata* crossed over to the *Thelomma.*

Specimens Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, 1899, *H.E. Hasse* (MIN); LOS ANGELES CO.: Ballona Bluff, 1905, (on *Thelomma*!) *H.E. Hasse* (FH).

66. *Stigmidium epixanthum* Hafellner*

Notes. – This is a wide-spread lichenicolous fungus on *Acarospora socialis* in southern California. We expect it to be rediscovered.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, iv.1910, Lichenes Exsiccati 127 (as *Acarospora xanthophana*), *H.E. Hasse* (FH).

67. *Thelopsis isiaca* Stizenb.

(Syn. *Thelopsis subporinella* Nyl. ex Hasse)

Notes. – This lichen was collected by Hasse on *Umbellularia californica.*

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, vi.1909, Lichenes Exsiccati 232, *H.E. Hasse* (FH).

68. *Thrombium aoristum* (Nyl.) Arnold

Notes. – Hasse reported *Thrombium epigaeum* (Pers.) Wallr. from the Santa Monica Mountains. The specimens that we have seen are in horrible shape, just dust. Othmar Breuss did get a good specimen from the Santa Monica Mountains and determined *T. aoristum* new for North America (Breuss 2002). The only specimen of *T. epigaeum* from California we have seen was recently collected at Point Loma

(Knudsen & Kocourková 2009a). We are skeptical of other reports based on Hasse and Fink and we have not seen a report from Butte County determined by Shirley Tucker (Tucker & Ryan 2006).

69. *Toninia ruginosa* ssp. *pacifica* Timdal

Notes. – Hasse collected *Toninia ruginosa* ssp. *pacifica* Timdal (Timdal 2002) on sandstone and usually determined it as *T. aromatica* (Sm.) A. Massal. (Hasse 1913). We have not collected *T. ruginosa* ssp. *pacifica* yet in the Santa Monica Mountains, but expect its rediscovery. Hasse collected *T. aromatica* from Ballona Bluffs in Los Angeles County, an area which has been channelized and industrialized, but determined it as *T. cummulata* (Sommerf.) T. Fries. *Toninia aromatica* has previously been reported from the Santa Monica Mountains (Knudsen 2007) where it appears to be rare at beginning of the 21th century, though it is quite common on the Channel Islands and to the south in the Santa Ana Mountains. Hasse's reports of *T. coeruleonigricans* (Lightf.) T. Fries are usually *T. submexicana* B. de Lesd., which he collected in the Santa Monica Mountains and which has also been reported in the 21st century (Knudsen 2007).

Selected Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, (as *Toninia coeruleonigricans*), *H.E Hasse* (FH).

70. *Verrucaria amylacea* Hepp

Notes. – Othmar Breuss determined a Hasse specimen of *Verrucaria amylacea* at W (Breuss, *pers. comm.*). All W collections examined by Breuss lacked specific locations in the Santa Monica Mountains. All *Verrucaria* species are expected to be rediscovered.

71. *Verrucaria dolosa* Hepp

Notes. – We have not collected this species yet, but it is expected. The specimen that we examined was identified as *Verrucaria integrella* Nyl. by Nylander. Hasse reported *V. integrella* from shale in the Santa Monica Mountains (Hasse 1913). We follow Breuss (2007) in separating *V. floerkeana* from *V. dolosa*. One Hasse collection at W was identified by Othmar Breuss as *V. dolosa* (Othmar Breuss, *pers. comm.*)

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, 1895, *H.E. Hasse 513* (NYL-H 3380).

72. *Verrucaria floerkeana* Dalla Torre & Sarnth.

Notes. – Othmar Breuss determined a Hasse specimen as *Verrucaria floerkeana* at W (Breuss, *pers. comm.*). He reported it also from the Channel Islands (Breuss 2007).

73. *Verrucaria macrostoma* Duf. ex DC.

Notes. – Othmar Breuss determined a Hasse specimen as *Verrucaria macrostoma* at W (Breuss, *pers. comm.*).

74. *Verrucaria nigrescens* Pers.

Notes. – Othmar Breuss determined a Hasse specimen of *Verrucaria nigrescens* at W (Breuss, *pers. comm.*).

75. *Xanthomendoza fallax* (Hepp ex Arnold) Søchting, Kärnefelt & S. Kondr.

Notes. – The Hasse specimen was apparently collected on *Quercus agrifolia*.

Specimen Examined. – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Range, vii.1906, Lichenes Exsiccati 122 (as *Xanthoria lychnea*), *H.E. Hasse* (FH!)

CONCLUSION

We keep three separate diversity lists for the Santa Monica Mountains. The first is a list of all species of fungi studied by lichenologists (lichens, lichenicolous fungi, and selected allied fungi) that have been verified as occurring or having occurred in the Santa Monica Mountains. It is assumed that with the rapid changes of urbanization and the fragmentation and reduction of undisturbed habitats in southern California that no new fungus species studied by lichenologists have migrated into the range. This first list should give us a probable baseline of all the species that occurred in the range at the beginning of 20th century. We report a total of 405 such taxa from the Santa Monica Mountains (354 lichens, 39 lichenicolous fungi, and 12 allied fungi). Though comparisons with Hasse's findings are hard to make. He reported 300 taxa, including a large number infraspecific taxa (many of which were misidentified or reported under names that have subsequently been synonymized) from the Santa Monica Mountains (Hasse 1913). The second list is comprised of those taxa only known from historical collections made before 1915. Some taxa, especially many saxicolous lichens, may have been equally rare in Hasse's time, and will eventually be rediscovered, like *Ramonia ablephora* reported in this paper. But a majority of these species may have been extirpated from the Santa Monica Mountains. We report a total of 94 such taxa (83 lichens, 3 lichenicolous fungi, 8 allied fungi). The third list is the consists of taxa documented as currently occurring in the range as a result of surveys at the beginning of the 21st century. We report a total of 311 such taxa (271 lichens, 36 lichenicolous fungi, and 4 allied fungi). This number represents our baseline for the beginning of the 21st century. The possible disappearance of 94 taxa from the biota of the Santa Monica Mountains cannot be attributed to one cause. Development, grazing, invasive plants, flood control, fire, mining, climate change and air pollution have all had effects. This needs further study.

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Stigmidium eucline is not a synonym of *Stigmidium aggregatum*

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ABSTRACT. – *Stigmidium aggregatum* and *S. eucline* are discussed. The ascospore size of *S. aggregatum* in current literature is revised. The synonymy of *S. eucline* with *S. aggregatum* is rejected.

KEYWORDS. – *Aspicilia calcarea*, *Lichenochora aprica*, lichenicolous fungi, *Pertusaria, Pharcidia aspiciliae, Zwackhiomyces calcariae.*

INTRODUCTION

In this paper, we investigate and reject the synonymy of *Stigmidium eucline* (Nyl.) Vězda with *S. aggregatum* (Mudd) D. Hawksw., confirming the first author's original observations published a decade ago (Kocourková 2000). Our rejection of the synonymy is based primarily on differences in the ascospore size, hamathecium, and hosts. We hope this paper will lead to the discovery of the types or new collections of *S. aggregatum*.

THE SPECIES

1. *Stigmidium aggregatum* (Mudd) D. Hawksw., Kew Bull., 30: 201. 1975.

Thelidium aggregatum Mudd, Man. Br. Lich., p. 298. 1861. TYPE: **IRELAND:** Barclays Rock, on *Aspicilia calcarea, Admiral Jones s.n.* (location of type unknown).

Pharcidia aggregata (Mudd) Vouaux, Bull. Soc. Mycol. France, 28: 252. 1912.

Syn. *Arthopyrenia aspiciliae* J. Lahm *in* Körb., Parerga Lichenol., p. 388. 1863. TYPE: **GERMANY:** Westphalia (Westfalen), Dulenberg near Höxter, on thallus of *Aspicilia calcarea, Beckhaus s.n.* (hb. Lahm, location of type unknown).

Pharcidia aspiciliae (J. Lahm) G. Winter, Rabenh., Krypt-Fl.. Deutschl., 2, Aufl. Bd. I/2: 346. 1885.

Verrucaria aspiciliae (J. Lahm) Stitzenb., Ber. Thätigk. St. Gall. Naturwiss. Ges., 22: 511. 1882.

Mudd (1861) described *Thelidium aggregatum,* a lichenicolous fungus on *Aspicilia calcarea*, based on a collection made by Admiral Jones on Barclay Rock, a location we assume is in Ireland. The original description stated that the ascomata are "…very minute, aggregated together into little groups, of from three to twelve apothecia, semi-immersed, hemispherico-globose, black; perithecium entire, the upper half very black, the lower one reddish-black; nucleus pale, submucoso-gelatinous; paraphyses indistinct; asci clavate, 8 spored; spores linear-oblong or oblong-subfusiform, bilocular, subhyaline to hyaline" (Mudd 1861). It should be noted that in Mudd's concept of *Thelidium,* species have paraphyses that are either distinct or that are indistinct. His use of indistinct means no interascal filaments were observed.

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	Length		Width		
	Mudd	Literature	Mudd	Literature	Literature Source
Dacampia hookeri	.006-.007	30-36	.0025-.003	11-16	Halici & Hawksworth 2008
Pertusaria leioplaca	.014-.021	40-130	.007-.009	25-50	Lumbsch & Nash 2002
Pertusaria pustulata	.016-.021	45-160	.007-.009	26-48	Lumbsch & Nash 2002
Pertusaria velata	.051-.061	130-210	.014-.016	28-64	Lumbsch & Nash 2002
Thelidium aggregatum	.005-.007		.001-.002		

Multiplication factor (= Mudd measurement / literature measurement)

	Length Range		Width Range		
Dacampia hookeri	5000	5143	4400	5333	
Pertusaria leioplaca	2857	6190	3571	5556	
Pertusaria pustulata	2813	7619	3714	5333	
Pertusaria velata	2549	3443	2000	4000	
				4345	**Average multiplication factor**

	Approximate length range		Approximate width range	
Thelidium aggregatum	21.73	30.42	4.35	8.69

Table 1. Method outlining conversion of Mudd's measurements of *T. aggregatum* to modern units.

Mudd reported an ascospore size of ".005 to .007 in. long by .001 to .002 in. broad". Unfortunately, to date no one has been sure of how to convert Mudd's measurements (Hawksworth & Seaward 1977) to those used in modern times. Mudd's statement that the ascospores of *Thelidium aggregatum* were "large" led us to question the synonymy with *S. eucline* since the ascospores of *Stigmidium* would not typically be described as "large". Thus we compared the measurements of *T. aggregatum* reported in the protologue with those of some other species with large ascospores as well as one with ascospores of comparable size. We then compared them to modern measurements of the same taxa taken from the literature (Table 1) and generated a conversion factor by dividing the modern measurements by those reported by Mudd. Although the size of this value is variable (2,000-7,600x), the average (4,345) when multiplied by Mudd's measurements for *T. aggregatum* provides an approximation of the reported size in terms we can understand today (22–30 × 4.5–9 µm).

Although we cannot obtain an exact conversion in microns from Mudd's measurements, the approximate size based on the above data is significant because it is well outside of the range reported for *S. eucline* (14–16(–18) × 4.5–6 µm (Kocourková 2000) or 11.5–18 × 5–5.5 µm (Sérusiaux et al. 2003)). Indeed, Mudd stated that the species could be easily recognized by its "large" ascospores. Clearly based on ascospore size alone, *S. aggregatum* and *S. eucline* should not be considered synonyms.

The process that led to the erroneous synonymy of *S. aggregatum* and *S. eucline* began when Vouaux (1912) published an incorrect conversion of Mudd's original measurement as "12.5–18 × 2.5–5 µm". As we have shown above (and in Table 1) the actual measurements are approximately twice those given by Vouaux. Vouaux arrived at his measurements by multiplying by 2,500 (and rounding 17.5 to 18); in reality, if "in" means inches, then he should have multiplied by 25,000, but, as this gives impossible results, he surely removed one 0 from the multiplication factor, or he even did this by mistake (P. Diederich, *pers. comm.*) It is clear that the size range given by Vouaux then entered the modern literature beginning with Keissler (1930). There is no published evidence that Vouaux saw Mudd's original material and thus we assume that he based his description on Mudd (1861).

Vouaux (1912) transferred the species to the genus *Pharcidia* Körb. as *Pharcidia aggregata* (Mudd) Vouaux. Vĕzda (1970) invalidly transferred *Pharcidia aggregata* to *Stigmidium* because he did not include the basionym when making his new combination. Hawksworth (1975) validated this combination as *Stigmidium aggregatum* (Mudd) D. Hawksw., mentioning its host as *Aspicilia calcarea,* but giving no ascospore size. Since none of these published data appeared to have been based on an actual examination of the type of *Thelidium aggregatum* we decided to search for it ourselves. We could not locate the holotype at Kew (K). We contacted David Hawksworth who could not recall having seen it, found no notes in his library that he had examined it, and recently did not locate the holotype himself at the British Museum (BM) (Hawksworth *pers. comm.*).

This taxon was apparently described a second time as *Arthopyrenia aspiciliae* J. Lahm on *Aspicilia calcarea* (Körber 1863). No ascospore size was given in the protologue, but they were described as having four oil drops (i.e., pseudotetrablastic), and being 3 to 4 times as long as wide. Körber (1893) stated that Lahm thought the species may be conspecific with *Thelidium aggregatum.* Regardless of this uncertainty, Winter (1885) transferred *A. aspiciliae* to *Pharcidia.* The description given by Winter paraphrases the protologue published by Körber (1863) and it is probable that Winter never saw the type, based on the lack of new information. We also doubt if Keissler saw the type specimens of either name when he synonymized *P. aspiciliae* with *P. aggregata* (Keissler 1930). Keissler's published description conflated aspects of the protologues published by Mudd (1861) and Körber (1863), essentially paraphrasing that of Mudd and adding the question about the possibility of having an extra septum from Körber.

We were unable to locate the holotype of *Arthopyrenia aspiciliae* in J. Lahm's herbarium at Berlin (B), in Körber's herbarium (L) or at Zurich (ZT). It is possible that it is not conspecific with *T. aggregatum.* It is probable that Keissler's synonymy was influenced only by Körber's comment that Lahm thought *A. aspiciliae* was possibly conspecific with *T. aggregatum.* But we follow Keissler's synonymy for now until the types are discovered or designated allowing a revision.

Since we could not locate the type specimens of either name, we also made an attempt to locate additional *Stigmidium* specimens on *Aspicilia* from Europe. We could locate only one possible collection. It was from Ireland and had been studied by H. Fox who provided the following information (*pers. comm.*) "The collection is in the Admiral Jones cabinet in [Dublin] DBN, there are a few clusters of perithecia divided by a few rimae on +/-areoles of the saxicolous sample. The host is (*Aspicilia*) *leprosescens* and was published as on an *Urceolaria*, and I put a label in the drawer. I am not sure of the status of the DBN collection, but it would be interesting to review it." Since the host of this specimen was published as *Urceolaria* and not *Aspicilia*, it is apparently not Mudd's type specimen of *S. aggregatum*. It is unclear to us whether the specimen is *S. aggregatum*, as we were unable to examine it (multiple loan requests to DBN went unanswered).

Based on the above investigation, until a revision is possible, we consider *Stigmidium aggregatum* to lack interascal filaments, be host specific to *Aspicilia* species, have small semi-immersed ascomata which may be aggregated, 8-spored asci, and 1-septate hyaline ascospores approximately 22–30 × 4.5–9 µm, which may have up to 4 oil drops and be pseudotetrablastic. The species is known only from three historical records from Germany, Switzerland, and Ireland (Mudd 1861; Körber 1863; Keissler 1930) based on specimens from the 19th century collected by Beckhaus, Müller and Jones. Based on the large size of ascospores it is possibly not even a species of *Stigmidium.*

If *Thelidium aggregatum* had interascal filaments Mudd failed to observe, it is possible that *T. aggregatum* is one of four species reported on *Aspicilia* species with similar sized ascospores: *Zwackhiomyces calcariae* (Flagey) Hafellner & Nik. Hoffman (Hoffman & Hafellner 2000), *Pharcidia calcariae* (Flagey) Vouaux f. *macrospora* Vouaux (Hoffman & Hafellner 2000), *Dothidea lichenicola* Massee (Saccardo 1882), and *Lichenochora aprica* Hafellner & Nik. Hoffman (Hoffman & Hafellner 2000). *Zwackhiomyces calcariae* has 1-septate ascospores shorter than *T. aggregatum,* 15–20 × 6–7 µm, but the only known specimen was immature, possibly accounting for the shorter length. Interascal filaments were present in the type of *Z. calcariae* but hard to observe. *Pharcidia calcariae* f. *macrospora* has 1-septate ascospores, 20–32 × 6–8 µm, a size much closer to *T. aggregatum. Lichenochora aprica* also has similar ascospores, 22.5–28 x 6–8.5 µm. *Dothidea lichenicola* has similar sized ascospores to *T. aggregatum,* 18–24 × 6–6.5 µm. Unless the types are discovered, we will never be sure what taxon was described as *T. aggregatum* or *Pharcidia aspiciliae.*

Stigmidium "*lendermerii*" Kocourk. & K. Knudsen ined. from North America occurs on several *Aspicilia* species, has 1-septate ascospores (15.0–)16.5–*17.87*–19.5(–21.0) × (5.0–)5.5–*5.88*–6.5(–6.5) µm, no interascal filaments, and long periphysoids (type b) (Kocourková & Knudsen in prep.) This taxon's ascospores are shorter and narrower than those Mudd reported from *T. aggregatum.*

2. ***Stigmidium eucline* (Nyl.) Vězda**, Čes. Mykol., 24(4): 228. 1970.

Mycoporum eucline Nyl., Flora, 57: 317. 1874. TYPE: **Hungary:** ad saxa granitica circa Thermas Herculis in Banatu, on *Pertusaria lactea*, 1874, *H. Lojka s.n.* (H-NYL, holotype; NY, isotype).

Cyrtidula euclinis (Nyl.) Minks, Revue Mycol., 13: 63. 1891.

Nylander (1874) described *Mycoporum eucline* Nyl. from *Pertusaria* (as *P. velata*) from Hungary. In Sérusiaux et al. (2003), Diederich revised the host to *Pertusaria lactea*. Vězda (1970) revised *M. eucline* when he transferred it to *Stigmidium* as *S. eucline* (Nyl.) Vězda. His description is detailed and includes the observation of interascal filaments. Nylander did not see interascal filaments, but Diederich did observe them in the isotype he examined and they are easily observed in modern collections with standard microscopy (Sérusiaux et al. 2003). Taxa with interascal filaments do not belong in *Stigmidium* s. str. (Roux & Triebel 1994; Sérusiaux et al. 2003; Calatayud & Triebel 2003; Kocourková & Knudsen 2009). At the time Vězda made the transfer to *Stigmidium,* many *Pharcidia* species were transferred to *Stigmidium* and there was no clear idea what constituted *Stigmidium* s. str.

The confusion between *Stigmidium aggregatum* and *S. eucline* arose when Hawksworth (1983), in his historic identification keys of the lichenicolous fungi of the United Kingdom, reported *S. aggregatum* on *Pertusaria lactea* from the upland areas of Scotland and Wales. He wrote at the end "[? Syn S. eucline (Nyl.) Vězda]". No mention was made of the previous published accounts of the species occurring on *Aspicilia.*

We believe Hawksworth should have used the name *Stigmidium eucline* in his key, adding the note "[? Syn *S. aggregatum* (Mudd) D. Hawksw.]". Understandably, at that time, while studying lichenicolous fungi, it was necessary (as now) not to be overly influenced by host-based thinking, as there are some lichenicolous fungi that occur on unrelated hosts. And at that time the use of the name would have been logical, based on the similarity in the pattern of ascomata aggregation and the published ascospore size of *S. aggregatum* given by Vouaux (1912). At this stage, the next investigative test should have been to revise the types of *S. aggregatum* and *S. eucline*.

Unfortunately, Santesson (1993: 213) made *Stigmidium eucline* a synonym of *S. aggregatum* without comment and reported it on *Ochrolechia lactea* (*Pertusaria lactea*) from Sweden and Norway. Obviously, in light of the evidence presented above, Santesson's report represents *S. eucline* s. str. and not *S. aggegratum* s. str. We seriously doubt whether Santesson investigated the type of *S. aggregatum* but rather based his decision on Hawksworth (1983). Following Santesson (1993), other lichenologists have treated *S. eucline* as a synonym of *S. aggregatum* (see Sérusiaux et al. 2003), though there was one dissent (Kocourková 2000).

Conclusion

We reject the synonymy of *Stigmidium eucline* with *S. aggregatum* based on the differences of ascospore sizes, the differences in hosts, and the differences in the hamathecium (interascal filaments vs. no interascal filaments). The name *S. eucline* should be used for the taxon on *Pertusaria* species having interascal filaments. The species concept is well formed (Vězda 1970; Kocourková 2000; Sérusiaux et al 2003). The species is widespread in Europe and quite common in central Europe (Kocourková 2000; Sérusiaux et al 2003). The name *S. aggregatum* should be used for a taxon with large ascospores on *Aspicilia*. We have stated above the problem involved in revising *Stigmidium aggregatum.* We hope the types or new specimens will be discovered soon.

Acknowledgements

We thank our reviewers Vicent Calatayud and Paul Diederich, especially the latter for his helpful comments and discussion. For discussion and assistance in various ways during our research, we thank Paul Diederich, Javier Etayo (Spain), David L. Hawksworth and Brian Coppins (UK), Howard Fox (Ireland), Harrie Sipman (B), Gerard Thijsse (L), Reinhard Berndt (ZT), Claude Roux (France), Walter Obermayer and Josef Hafellner (GZU), and especially J.C. Lendemer (NY). We thank Thomas Nash for his hospitality to the second author during his visit to the ASU Herbarium, where part of this paper was researched. The work of Jana Kocourková was supported by the Department of Ecology, University of Life Sciences, Prague, Czech Republic.

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New and interesting lichens, lichenicolous and allied fungi from Yosemite National Park, California, U.S.A.

James C. Lendemer[1], Kerry Knudsen[2] & Alan M. Fryday[3]

ABSTRACT. – *Caloplaca lecanoroides*, a corticolous sorediate species is described as new to science. The nomenclature and typification of *Lecanora semitensis* is discussed, a lectotype is selected and a brief treatment of the species is provided. *Rhizocarpon bolanderi* var. *sulphurosum* is raised to the species level as *R. sulphurosum*. *Naetrocymbe saxicola* is reported new to North America and California. The following taxa are newly reported for California: *Acarospora sinopica*, *Arthonia excentrica*, *Ionaspis lacustris*, *Niesslia peltigericola* (on *Peltigera didactyla*), *Pezizella epithallina* (on *Peltigera didactyla*), and *Xylographa soralifera*. *Lichenothelia scopularia* is discussed and verified as occurring in California.

Introduction

During September 18–23, 2009 we participated in a foray to Yosemite National Park in the Sierra Nevada Mountains of California. The purpose of the foray was to bring together a group of lichen specialists to survey the lichen diversity of sites in the National Park. A checklist of the lichen biota of the National Park is currently being prepared by the organizers of the foray: however a number of new and interesting species were encountered that require more explanation or description than can be afforded in the context of a checklist. We thus compiled the present contribution. Other collections are still undergoing investigation, and further additions to the lichenized mycobiota of California are expected, which will be dealt with in future publications.

Materials and Methods

Specimens were studied dry using a Bausch and Lomb StereoZoom 7 and Leica dissecting microscopes and subjected to chemical analysis using standard spot tests (reagents are abbreviated following Brodo et al. (2001)) and Thin Layer Chromatography (TLC). TLC was carried out using solvent systems A and C following the standardized methods of Culberson and Kristinsson (1970). Microscopic characters were measured in water and images were captured using an Olympus DP20 digital camera with Microsuite Special Edition by JCL at NYBG. Illustrations were prepared using Adobe Photoshop. Mounts were prepared by hand with a razor blade and placed in water. Measurements are based on water mounts. Reported size ranges of the soredia, paraphyses tips, and ascospores in the description of *Caloplaca lecanoroides* are expressed as (Xbar-1SD)-Xbar-(Xbar+1SD) followed by the sample size. The ascospore size ranges of *Lecanora semitensis* are expressed as above except that the highest and lowest bounds are also given in brackets at either end of the range.

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I – New and interesting lichens

1. *Acarospora sinopica* (Wahlenb.) Körb.

This crustose species is cosmopolitan (Fletcher et al. 2009a). It has been reported in North America from Greenland and eastern Canada south to the White Mountains in the United States (Thomson 1997). *Acarospora sinopica* absorbs iron. At Pigeon Gulch, where it was locally abundant, the rock was rich in iron as well as barium. It is part of *Acarospora* s. str. and not part of the *A. smaragdula* group (Wedin et al 2008). The species is here reported new for California. For a good description see Fletcher et al. (2009a).

Specimen Examined. – **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite National Park, Moss Creek Boardwalk, elev. 653 m., on rock, 20.ix.2009, *J.C. Lendemer 19651* (NY), *J.C. Lendemer 19656* (NY); *ibid.,* Mouth of Pigeon Gulch at Highway 140, elev. 621 m., on iron-rich rock, 20.ix.2009, *K. Knudsen 11665* (UCR, hb. Yosemite NPS). *A.M. Fryday 9307, 9324* (MSC).

2. *Caloplaca lecanoroides* Lendemer sp. nov.

Mycobank #518078.

Plate 1 (Page 109).

Ad *Caloplacae obscurellae* sed thallo areolato et robusto, apotheciis grandioribus (0.6-1.0 mm diam.) et *Lecanorae subfuscae* similis.

TYPE: **U.S.A. CALIFORNIA**. MARIPOSA CO.: Yosemite National Park, vicinity of base of Bridal Veil Falls, elev. 1298 m., massive granite boulders in stream ravine with cold air flow, mixed conifer (*Abies, Pinus, Calocedrus*) forest with occasional hardwoods, on *Quercus*, 22.ix. 2009, *J.C. Lendemer et al. 19722* (NY, holotype; LD, isotype).

Description. – Thallus pale gray, sorediate, areolate-verruculose, 80-110 µm thick; cortex 10–20 µm thick, prosoplectenchymatous, with the uppermost layer of cells weakly pigmented (K-); algal layer variable, 60–80 µm thick; soralia laminal on the areoles, excavate and with a distinct raised margin (e.g., cupuliform), 0.15–0.25 mm in diameter; soredia globose, fine, often with distinctly pigmented outer layer (K-), (24)–27–(30) µm in diameter (n=20). Apothecia sessile, round to irregular, resembling those of the *Lecanora subfusca* group, 0.6–1.0 mm in diameter; disc reddish-brown, flat to weakly convex with age; proper margin hyaline, with a distinctly prosoplectenchymatous layer composed of cells 3-5 µm wide; thalline margin present and well developed, sometimes becoming slightly excluded with age; epihymenium brown to light reddish-brown, K-, without granules; hymenium hyaline, not inspersed, 70-80 µm tall; hypothecium hyaline, weakly inspersed with oil droplets, 60–80 µm tall; paraphyses apically expanded, (3.5)–3.8–4.2–(4.5) µm wide (n=20); asci *Teloschistaceae*-type; ascospores (12.5)–13.4–(14.3) x (5.8)–6.6.–(7.3) µm (n=20), isthmus (3.5)–4.7–(5.5) µm (n=20).

Etymology. – The epithet “lecanoroides” refers to the resemblance of the apothecia to those of the genus *Lecanora*.

Ecology and distribution. – The new species is known only from the type collection, which was found growing on the bark of an oak (*Quercus*) in a densely shaded, humid, boulder strewn ravine leading away from the base of a waterfall.

Discussion. – As the epithet suggests, the most striking feature of *Caloplaca lecanoroides* is the resemblance of the apothecia to those of the *Lecanora subfusca* group. The only other *Caloplaca* species with apothecia that have been described in a similar manner is *C. diphasia* (Tuck.) Wetmore. While both *C. diphasia* and *C. lecanoroides* lack thalline anthraquinones and have similarly sized ascospores, *C. diphasia* lacks soralia and has a dark golden brown pigmented epihymenium that reacts K+ yellow or red-violet (Wetmore 1994). Also the two species are allopatric: *C. diphasia* is restricted to southwestern North America (Mexico and Texas, U.S.A.) while *C. lecanoroides* is known only from a high elevation site in the Sierra Nevada Mountains of north/central California.

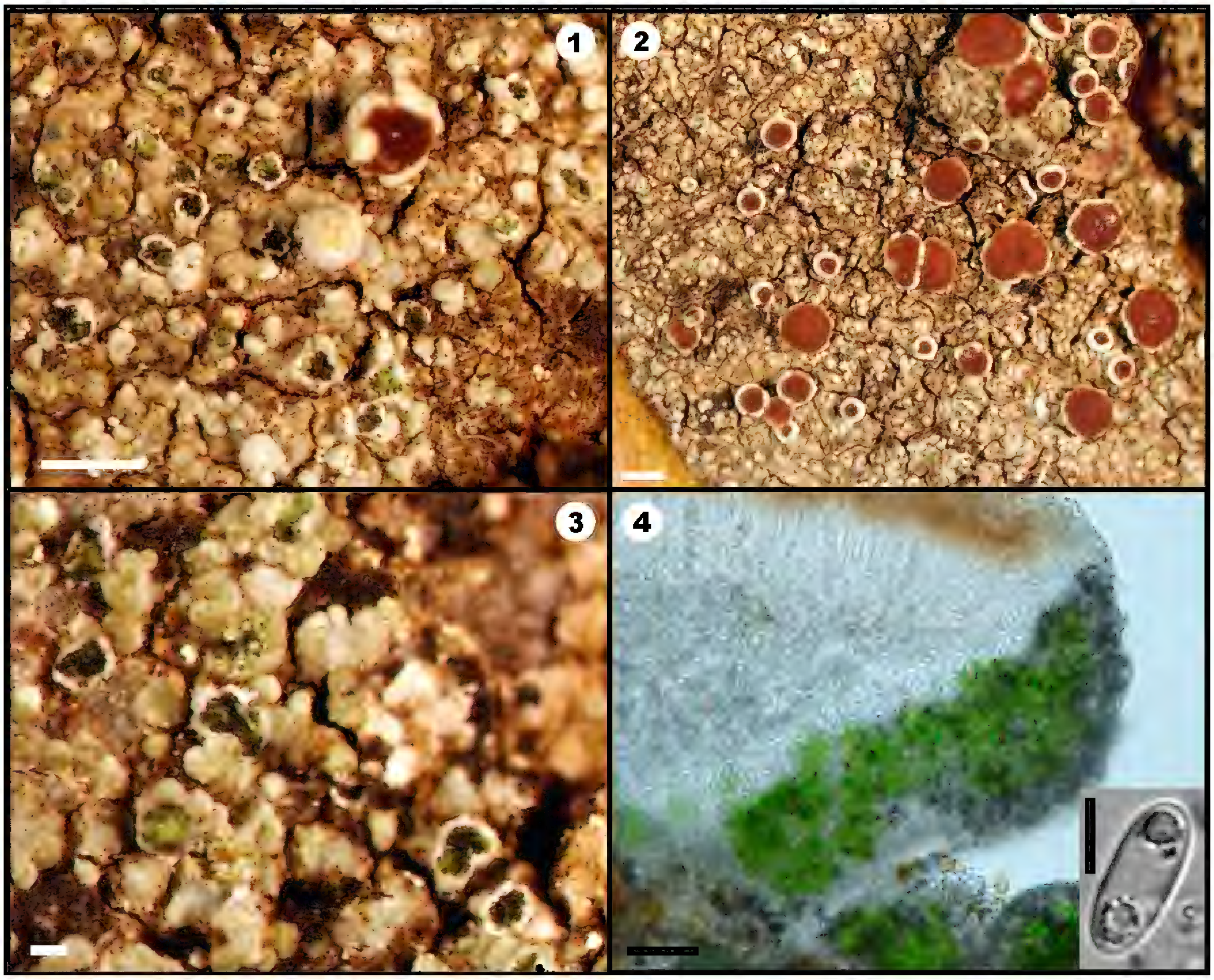

Plate 1. *Caloplaca lecanorioides* (all from holotype). Figure 1, soralia and deformed apothecium (scale = 0.5 mm). Figure 2, gross morphology of thallus with mature apothecia (scale = 0.5 mm). Figure 3, detail of soralia (scale = 0.1 mm). Figure 4, section of apothecium (scale = 50 µm) and an ascospore inset (scale = 5 µm).

Among the North American sorediate species with a gray thallus (Wetmore 1996, 2009) *Caloplaca lecanoroides* is only likely to be confused with *C. obscurella* (J. Lahm *ex* Körb.) Th. Fr. and *C. pratensis* Wetmore. Indeed, *C. obscurella* and the new species share the characters of ascospore size, cupuliform soralia, prosoplectenchymatous proper exciple, and absence of anthraquinones. *Caloplaca obscurella* differs markedly from the new species in having much smaller apothecia (less than half the size, compare plates 1 and 2 herein) that lack a well developed persistent thalline margin, and a much thinner thallus in which the areoles are almost imperceptible (Wetmore 1994; Søchting 1994). *Caloplaca pratensis* is also readily distinguished from the new species in having K+ purple pigments in the thallus and apothecia, irregular soralia that are not discrete and cupuliform, and larger ascospores (15.5–17.0 x 7.0–8.5 µm) with a narrower isthmus (<2 µm). Neither of these species have been reported from California.

COMPARATIVE SPECIMENS OF *CALOPLACA OBSCURELLA* EXAMINED. – **AUSTRIA. STEIERMARK:** Leoben District, 2 km W of the village Proleb, 24.vii.2004, on *Fraxinus excelsior*, *J. Vondrák s.n.* (NY; distributed as *Selected exsiccates of Caloplaca 1: 10*). **BULGARIA. KHASKOVO PROV.:** Rhodope Mountains, Madzharovo District, Silen, 18.viii. 2004, on *Populus nigra*, *J. Vondrák s.n.* (NY; distributed as *Selected exsiccates of Caloplaca 1: 13*).**CANADA. BRITISH COLUMBIA:** Vancouver, Stanley Park, 2.xii.1995, on *Acer*, *T. Tønsberg 23748* (NY). **GERMANY:** in der Umgegend von Münster im Westfahlen, sine date, on *Populus dilatata*, *Nitschke & Lahm s.n.* (NYx2; distributed as *Flechten Europa 881*).

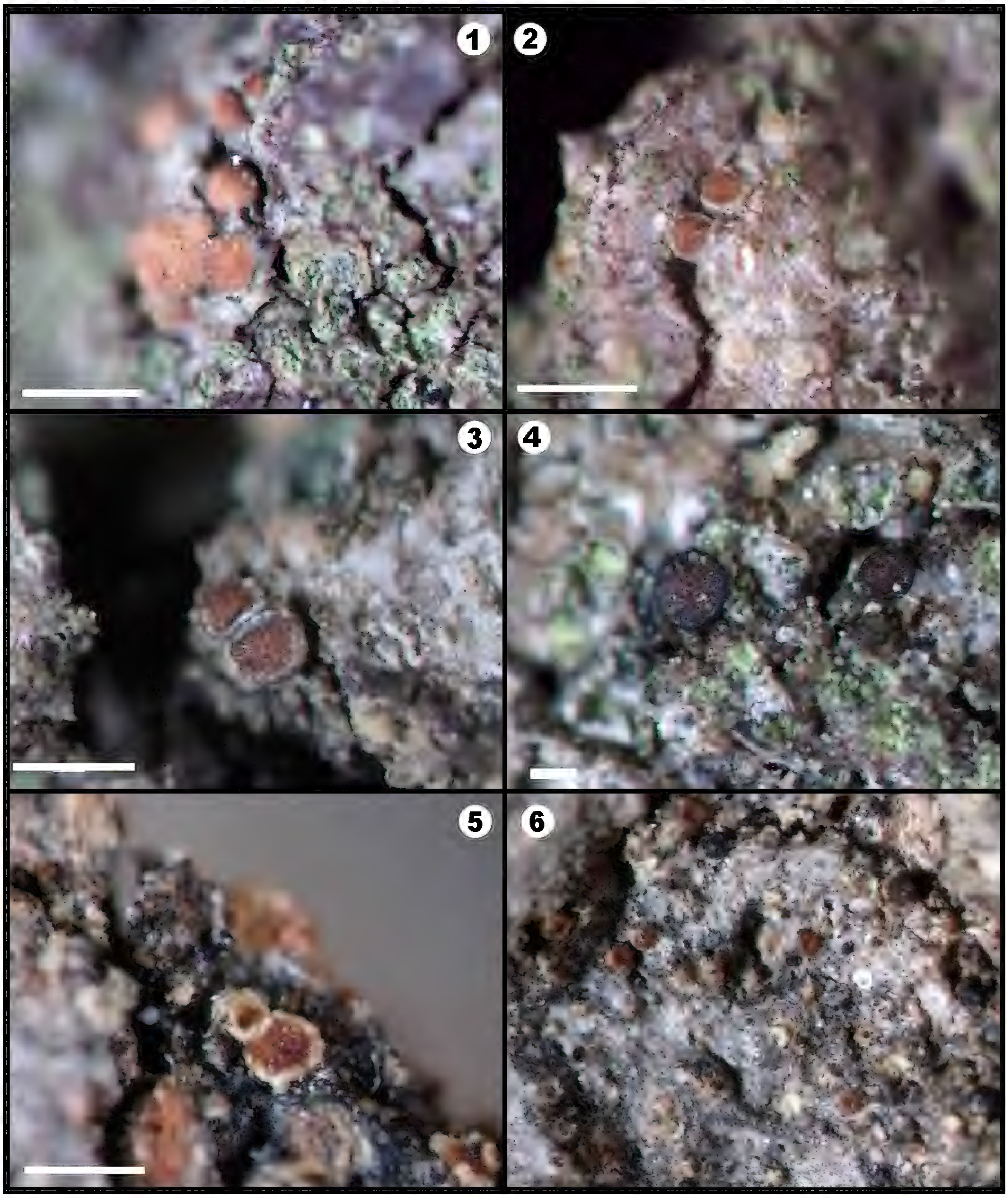

Plate 2. *Caloplaca obscurella*. Figures 1-4, variability of apothecia from a single specimen (*Vondrák s.n.* = *Sel. Exs. Caloplaca 10*; scale = 500 µm except in four where scale = 0.1 mm). Figure 5, apothecia with thalline margin (*Hepp s.n.* = *Fl. Eur. 881*, scale = 500 µm). Figure 6, gross aspect of thallus (*Hepp s.n.* = *Fl. Eur. 881*, magnified 2 x).

3. *Ionaspsis lacustris* (With.) Lutzoni

This distinctive orange-brown crustose lichen is cosmopolitan (Fletcher et al. 2009b). *Ionaspis alba* Lutzoni is frequent in central California (Owe-Larsson & Nordin 2008), but previously *I. lacustris* has only been reported from western North America as far south as Oregon (Brodo et al. 2001; previous reports from California are apparently erroneous). The species was growing on iron-rich rock in Pigeon Gulch where it would be inundated part of the year. It is reported new for California. For a color illustration see Brodo et al. (2001) and for a description see Fletcher et al. (2009b).

Specimen Examined. – **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite National Park, mouth of Pigeon Gulch at Highway 140, 621m., on iron-rich rock, 20.ix.2009, *K. Knudsen 11670* (UCR, hb. Yosemite NPS).

4. *Lecanora semitensis* (Tuck.) Zahlbr., Cat. Lich. Univers., 5: 661. 1928.

Lecanora "*semitensis* subsp. nov." Tuck. *nom. inval.*, Proc. Amer. Acad. Arts & Sci., 12: 168. 1877.

Lecanora muralis var. *semitensis* Tuck., Syn. North Amer Lich., 1: 184. 1882. TYPE: **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite Valley, *sine date*, on granite, *H.N. Bolander s.n.* (FH-TUCK sheet #1872 [HUH-00197470], lectotype (**selected here**); syntype, FH-TUCK sheet #1872 [HUH-001497469]). EPITYPE: **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite National Park, N side of Wawona Rd. (CA41), 2 mi W of Wawona Tunnel, on seep slabs above The Rostrum, South Rim of Yosemite Valley, elev. 1449 m., exposed granite ledges, on granite, 22.ix.2009, *J.C. Lendemer 19740* (NY, epitype; FH, GZU, OSC, UCR, hb. Kalb, isotypes).

Lecanora saxicola var. *semitensis* (Tuck.) Hasse *comb. inval.*, Contr. U. S. Nat. Herb., 17: 93. 1913.

Plates 3-4 (Pages 112-113).

Nomenclatural note. - When Tuckerman (1877) introduced the name *"Lecanora semitensis*" he indicated the rank of the new taxon as "subsp. nov." but failed to associate the infraspecific epithet with a species. Subsequent authors (e.g., Ryan et al. 2004) considered Tuckerman's discussion of *L. saxicola* var. *diffracta* (Ach.) Rabenh., in the protologue to be an indication that he intended to describe the new taxon as a variety of *L. saxicola* (Pollich) Ach., and have thus considered the name to have been validly published as *L. saxicola* var. *semitensis* Tuck. In fact, the *International Code of Botanical Nomenclature* (McNeill et al. 2006; Art. 33.1, ex. 4), gives an identical example involving a lichen name introduced by Tuckerman, where an infraspecific epithet introduced without a corresponding specific epithet is not considered to be validly published. Thus the name *L. "semitensis*" was invalidly published by Tuckerman (1877).

Tuckerman (1882) did however validly publish the name *Lecanora muralis* [var.] *semitensis* Tuck. by publishing a description and including a reference to the original 1877 publication of *L. "semitensis*". Zahlbrbucker (1928) subsequently was the first to use the epithet at the species level, effectively publishing the new combination of *L. semitensis* (Tuck.) Zahlbr., the basionym of which is *L. muralis* var. *semitensis* not "*L. saxicola* var. *semitensis*".

Typificiational Note. – A lectotype for *Lecanora muralis* var. *semitensis* Tuck. is selected here from among the original material collected by Bolander and deposited in the Tuckerman herbarium at FH. All of the original material at FH was poorly developed and consisted of only a few apothecia that will not allow much additional study in the future. Thus to aid future workers we have chosen to select an epitype the consists of well developed material with duplicates that have been distributed to lichen herbaria both in North America and in Europe.

Description. – The description published by Ryan et al. (2004) corresponds well to the specimens examined. However it should be qualified with the following range of measurements for the ascospores [9.6–](10.1–)10.9(–11.6)[–12] x [5.5–](5.9)–6.7–(7.6)[–8.0] µm. Also pycnidia were not observed, but reported by Ryan et al. (2004) to be common, black, with filiform conidia.

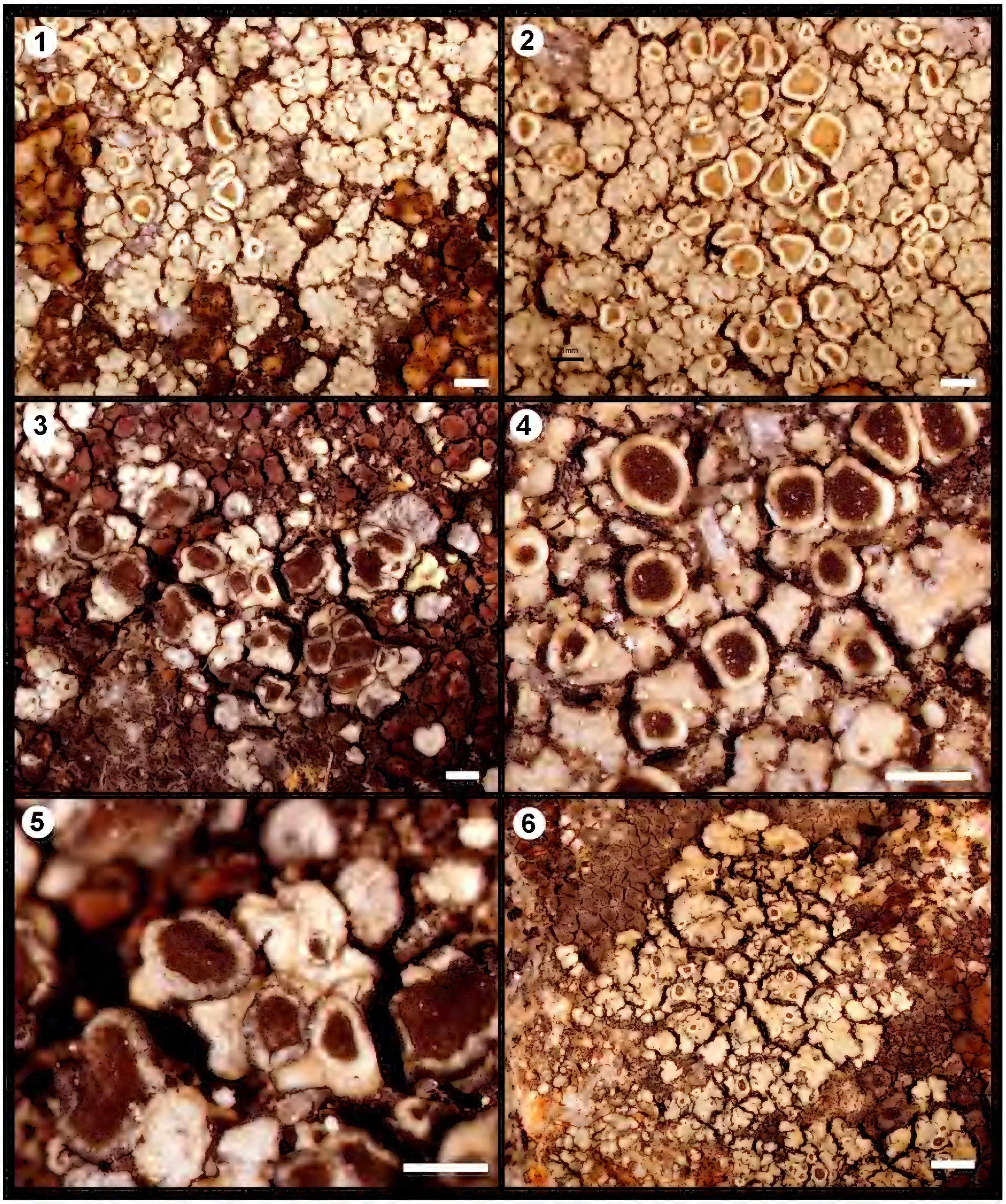

Plate 3. *Lecanora semitensis*. Figures 1-2, form with pale apothecial discs (*Lendemer 19747*, scale = 1 mm). Figure 3, form with lobate areoles growing over a thallus of *Rhizocarpon bolanderi* (*Lendemer 19734*, scale = 0.5 mm). Figures 4, detail of apothecia and areoles (*Lendemer 19733*, scale = 0.5 mm). Figure 5, detail of apothecia and areoles (*Lendemer 19734*, scale = 0.5 mm). Figure 6, rosette forming thallus growing in mixed crustose lichen community (*Lendemer 19740*, scale = 1 mm).

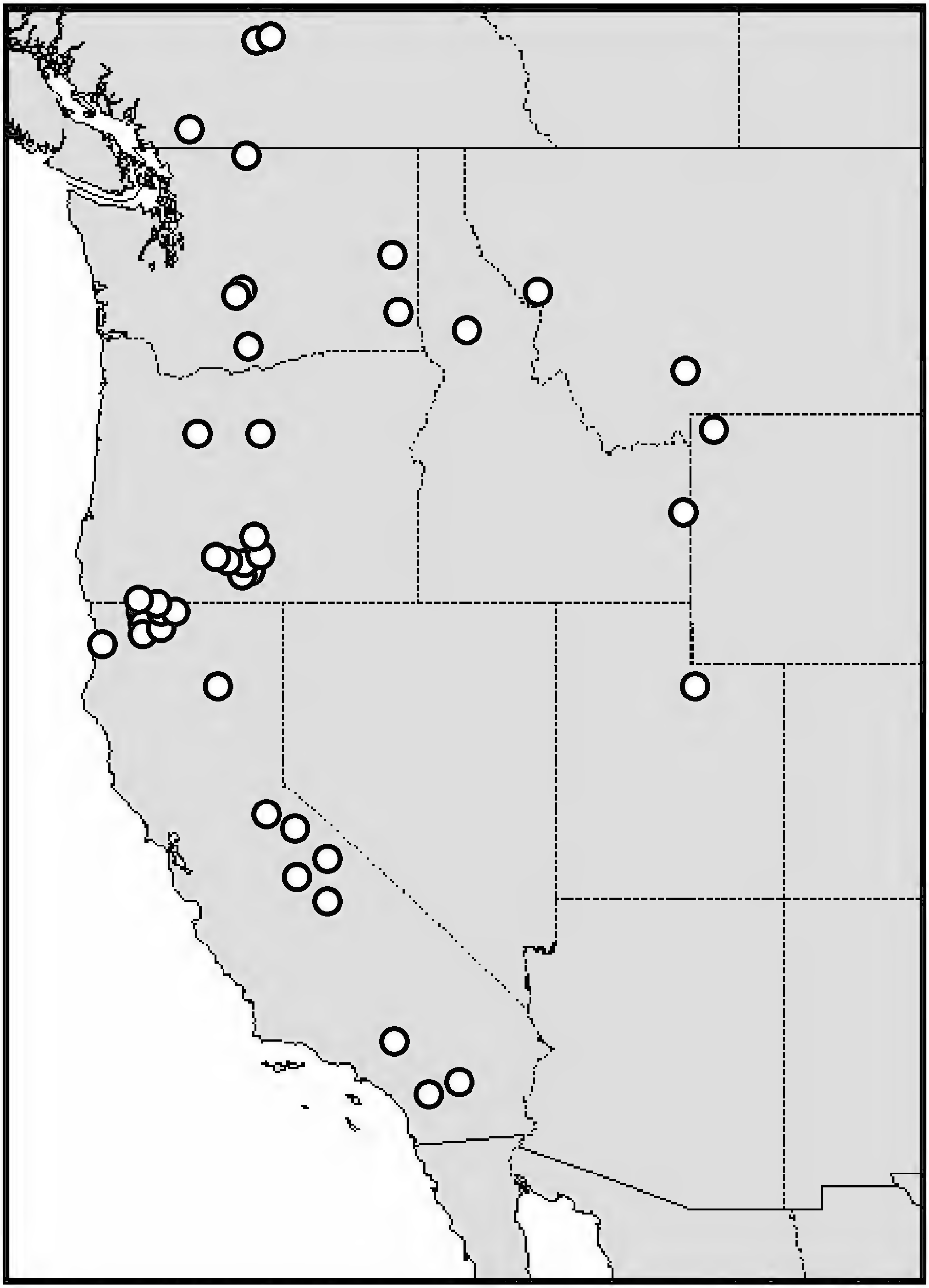

Plate 4. Geographic distribution of *Lecanora semitensis* based on specimens at NY and records from the Consortium of North American Lichen Herbaria (http://symbiota.org/nalichens/index.php)

CHEMISTRY. – Usnic acid (cortex), ± fatty acid? (medulla?). – Spot tests: cortex, K-, KC+ yellow, C-, P-, UV-; medulla, K-, KC-, C-, P-, UV-.

Usnic acid is the only lichen substance that is consistently detected in specimens of *Lecanora semitensis*. The species is typically a minor component of the lichen communities it occurs in, and as such is frequently mixed with or overgrowing thalli of other crustose lichens. It is thus hard to obtain TLC samples that consist only of *L. semitensis* and chemical analysis often reveals traces of substances other than usnic acid. These substances can usually be traced to thalli of species growing in close association with *L. semitensis*.

As was noted by Ryan et al. (2004), fatty acids are occasionally detected in specimens of this taxon. Whereas the detection of other substances is likely a result of contamination, the samples in which fatty acids were detected appear not to have been a mixture. In the specimens we have examined, only one fatty acid is detected in a given sample and it appears that different samples have different fatty acids (e.g., they have significantly different rf values). Since the presence of fatty acids in *L. semitensis* is not constant, and different fatty acids seem to be involved we conclude that this is not a taxonomically valuable character. Ryan et al. (2004) also reported placodiolic acid and isousnic acid as occurring in the cortex of some specimens of *Lecanora semitensis*. We cannot confirm these reports based on the specimens we have examined.

ECOLOGY. – *Lecanora semitensis* is a common member of the crustose lichen communities on exposed granitic rocks in the montane elevations of western North America. It is frequently a minor component of the communities it occurs in and as such is found as small scattered thalli growing mixed with or overgrowing other crustose lichens.

DISTRIBUTION. – Based on the data available online from the Consortium of North American Lichen Herbaria (http://symbiota.org/nalichens/index.php) *Lecanora semitensis* is widely distributed throughout western North America (Plate 4). The distribution map presented here is based on a compilation of the records available from this online source and those we have revised or collected (cited below).

DISCUSSION. – *Lecanora semitensis* is a distinctive member of the montane lichen biota of western North America. Although morphologically somewhat polymorphic in the color of the apothecial discs (yellow-brown to red-brown) it can be separated from all other usnic acid containing *Lecanora* species in the region by its dispersed areolate thallus, sessile apothecia, and general lack of secondary metabolites in addition to usnic acid. Members of the *L. polytropa*-group (e.g. *L. intricata* (Schrad.) Ach., *L. polytropa* (Hoffm.) Rabenh., and *L. stenotropa* Nyl.), which can also have areolate thalli and produce usnic acid in the cortex, are most likely to be confused with *L. semitensis*. However, they produce zeorin in addition to usnic acid and have waxy yellowish or blackish-brown rather than reddish-brown apothecial discs.

ADDITIONAL SPECIMENS EXAMINED. – **U.S.A. CALIFORNIA.** MARIPOSA CO.: same as the epitype collection, 22.ix.2009, *J.C. Lendemer 19733* (NY), *J.C. Lendemer 19734* (NY), *J.C. Lendemer 19739* (NY, OSC); Yosemite National Park, S side of Merced River, downstream of Phono Bridge, W end of Yosemite Valley, elev. 1172 m., mesic N-facing talus slope, canopy of *Pinus lambertiana, Calocedrus decurrens, Abies concolor, Pseudotsuga mertensiana, Quercus kelloggii, Acer macrophyllum* with understory of *Cornus nuttallii*, on granite, 22.ix.2009, *J.C. Lendemer 19747* (H, NY). TUOLUMNE CO.:Yosemite National Park, pullout on Hetch Hetchy access road just E of Poopenaut Dome, Tuolumne River Canyon south rim, elev. 1467 m., *Quercus kelloggii, Q. chrysolepis* woodland and granite boulders, on granite, 19.ix.2009, *J.C. Lendemer 19606* (NY). RIVERSIDE CO.: San Bernardino National Forest, San Jacinto Mountains, Thomas Mountain, elev. 1644 m., Coulter pine/chaparral and granite boulders, on granite, 5.x.2008, *J.C. Lendemer 14807 & K. Knudsen* (NY); San Bernardino National Forest, Santa Rosa Mountains, Santa Rosa Mountain, north slope, elev. 2048 m., conifer-oak woodland with granite outcrops, on granite, 8.x.2008, *J.C. Lendemer 14997-A & K. Knudsen* (NY).

5. *Naetrocymbe saxicola* (A. Massal.) R. C. Harris

This saxicolous crustose lichen species, which can be easily overlooked due to its small perithecia and thin to scant thallus, was recently revised and treated in detail by Roux (2009) who upheld the genus *Naetrocymbe* as proposed by Harris (1995). The present collection of *N. saxicola* was scant and partially overgrown by the areoles of a *Verrucaria* species. It confirms previous observations of rare perithecia in specimens of *N. saxicola* from southern California (San Diego and San Bernardino Counties) that were exhausted during the course of study. The species is apparently widespread but rare in California, and so far it has only been collected in mixed saxicolous communities or overgrown by cyanobacteria. For illustrations of the species see Roux (2009; free download from http://lichenologue.org/fr/) or Thüs and Schultz (2009; under the name *Pyrenocollema saxicola* (A. Massal.) Coppins). For good descriptions in English refer to Thüs and Schultz (2009) and Coppins & Orange (2009; under the name *Arthopyrenia saxicola*). Two other species of *Naetrocymbe* known from California are also rare: *N. herrei* K. Knudsen & Lendemer, a saxicolous lichen with a thick dark thallus (Knudsen & Lendemer 2009), and *N. punctiformis* (Pers.) R.C. Harris, a corticolous microfungus (Knudsen & Kocourková in press.). Currently *N. punctiformis* is listed as *Arthopyrenia punctiformis* (Pers.) A. Massal. on the North American lichen checklist (Esslinger 2009)

Specimen Examined. – **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite National Park, Mouth of Pigeon Gulch at Highway 140, elev. 535 m, on rock, 20.ix.200, *A. Fryday 9318* (MSC).

6. *Rhizocarpon sulphurosum* (Tuck. *ex* Willey) Lendemer stat. nov.

Mycobank #518080.

Plate 5 (Page 115).

Buellia bolanderi var. *sulphurosum* Tuck. *ex* Willey, Syn. N. Amer. Lich., 2: 103. 1888. TYPE: "Oregon, *Cusick*" (FH, not seen).

Rhizocarpon bolanderi var. *sulphurosum* (Tuck. *ex* Willey) Zahlbr., Cat. Lich. Univers., 4: 347. 1927.

Nomenclatural note. – The name for this taxon was originally published as "b. *sulphurosum* Tuck. herb." in the second part of Tuckerman's *A synopsis of North American lichens* (Tuckerman 1888) which was posthumously published by Henry Willey. Consequently, as shown by Coppins and Fryday (2006) the correct authority should be "Tuck. *ex* Willey" or "Willey" and not "Tuck.".

Discussion. – This taxon was originally described as a variety of *Rhizocarpon bolanderi* (Tuck.) Herre with a yellow pigmented instead of unpigmented medulla. However, the name is not currently included on the North American lichen checklist (Esslinger 2009). In treating *R. bolanderi*, Feuerer and Timdal (2004) mentioned that the variant may represent a distinct taxon. During our foray in Yosemite National Park we collected it at a montane locality on exposed granite rocks. At this site *R. bolanderi* var. *sulphurosum* grew abundantly and was the dominant species in some areas. Although the only difference between this taxon and *R. bolanderi* is the presence of medullary pigment it seems illogical to continue to employ an infraspecific rank in the absence of any concrete data regarding its relationship to *R. bolanderi*. Therefore we elevate this taxon to the rank of species, inserting it into the taxonomic dialogue and hopefully prompting study with molecular methods to determine if the yellow pigmented populations represent a monophyletic entity distinct from *R. bolanderi* s. str. It should be noted that *R. bolanderi* is common and occurs in North America (western portion of the continent and Greenland) and Europe

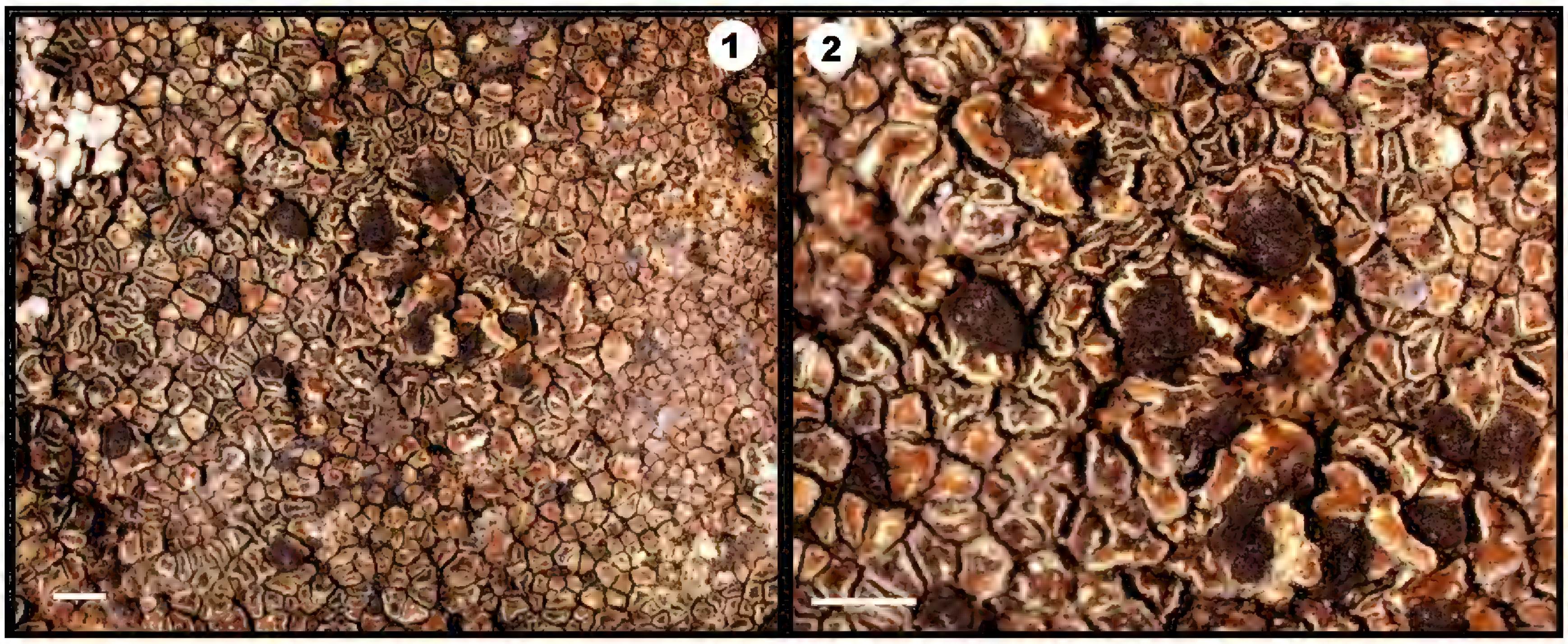

Plate 5. *Rhizocarpon sulphurosum* (*Lendemer 19738*). Figures 1-2, thallus and detail of apothecia (scale = 1 mm in both images).

(Norway) while *R. sulphurosum* is rare and restricted to northwestern North America (Feuerer & Timdal 2004). It is also interesting that a yellow pigmented form of *R. geminatum* Körb. has been reported from western North America (Feuerer & Timdal 2004), however no name is presently available for those populations.

Specimens Examined. – **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite National Park, N side of Wawona Rd. (CA41), 1 mi W of Wawona Tunnel, elev. 1449 m., exposed granite ledges, on granite, 22.ix.2009, *J.C. Lendemer 19738* (NY, hb. Yosemite NP).

7. *Xylographa soralifera* Holien & Tønsberg

This sorediate lignicolous species was recently described by Holien and Tønsberg (2008). Although apparently common elsewhere in western North America, it has not yet been reported from California. During our foray we found the species to be locally abundant on old dry wood at two localities. *Xylographa soralifera* was previously included in a broad concept of *X. vitiligo* (Ach.) J.R. Laundon. According to the protologue the two species differ in thallus characters, however these differences are variable and the most reliable character is chemistry. Fumarprotocetraric acid is produced by *X. soralifera* whereas *X. vitiligo* produces stictic acid.

Specimens Examined. – **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite National Park, bottom of Tuolumne Grove, North Crane Creek, elev. 1696 m., on log, *J.C. Lendemer 19567* (NY, hb. Yosemite NP); Yosemite National Park, Old Carlon Campground along North Crane Creek, elev. 1286 m., mixed conifer-oak forest, on dead conifer stumps, 19.ix.2009, *A. Fryday 9276, 9279, 9281* (MSC).

II. - Interesting lichenicolous and allied fungi

8. *Arthonia excentrica* Th. Fr.

Arthonia excentrica is a lichenicolous fungus on species of *Lepraria* Ach. and *Leprocaulon subalbicans* (I.M. Lamb) I.M. Lamb & A.M. Ward (Alstrup & Hawksworth 1990, Ihlen & Wedin 2008) that, in North America has been reported from Oregon (Hafellner et al. 2002). We found the species to be abundant on thalli of *Lepraria elobata* Tønsberg at one site in the high country during our foray and report it here for the first time from California. It should be noted that the available literature provides contradictory characters for *A. excentrica*. Ihlen and Wedin (2008) reported it as having an I+ blue hymenium and 1-septate ascospores (11-13 x 5-6 µm) while Alstrup and Hawksworth (1990) reported the hymenium to be I+ red and the ascospores larger (13-15-(17) x 5-6 µm). Our collections have I+ red hymenia and ascospores 14.5-16.8 x 4.8-7.2 µm.

Specimens Examined. – **U.S.A. CALIFORNIA.** TUOLUMNE CO.: Yosemite National Park, Mammoth Peak Overlook on Tioga Pass between Tuolumne Meadows and Tioga Pass Entrance Station, Dana fork of the Tuolumne River, elev. 2883 m., montane meadow surrounded by encroaching *Pinus contorta*, on *Lepraria elobata* on soil, 21.ix.2009, *J.C. Lendemer 19690* (NY), *J.C. Lendemer 19692* (NY).

9. *Lichenothelia scopularia* (Nyl.) D. Hawksw.

Lichenothelia scopularia is a saxicolous microfungus previously reported in California from the Santa Rosa Plateau in the Santa Ana Mountains (Weber et al. 1987) and from Alpine County (Tucker & Ryan 2006). We have not yet verified the collections upon which those reports are based and consider them tentative because the name has often been used in determinations by American lichenologists for all members of the genus that have black areolate thalli. We can however, confirm that *Lichenothelia scopularia* occurs in the Yosemite Valley. It was collected there by Henry Bolander during the 19th century and during our recent excursion.

For a description of the species see Hawksworth (1981). Our specimen differed from Hawksworth's description in rarely having as few as two ascospores per ascus, though most asci had eight ascospores. The species often grows in the middle of lichen thalli, where it can be easily overlooked, and thus collections are usually of well-developed independent thalli. Our specimen is actively lichenicolous on an *Aspicilia* species. Jana Kocourková (*pers. comm.*) has also observed lichenicolous thalli of *L. scopularia*

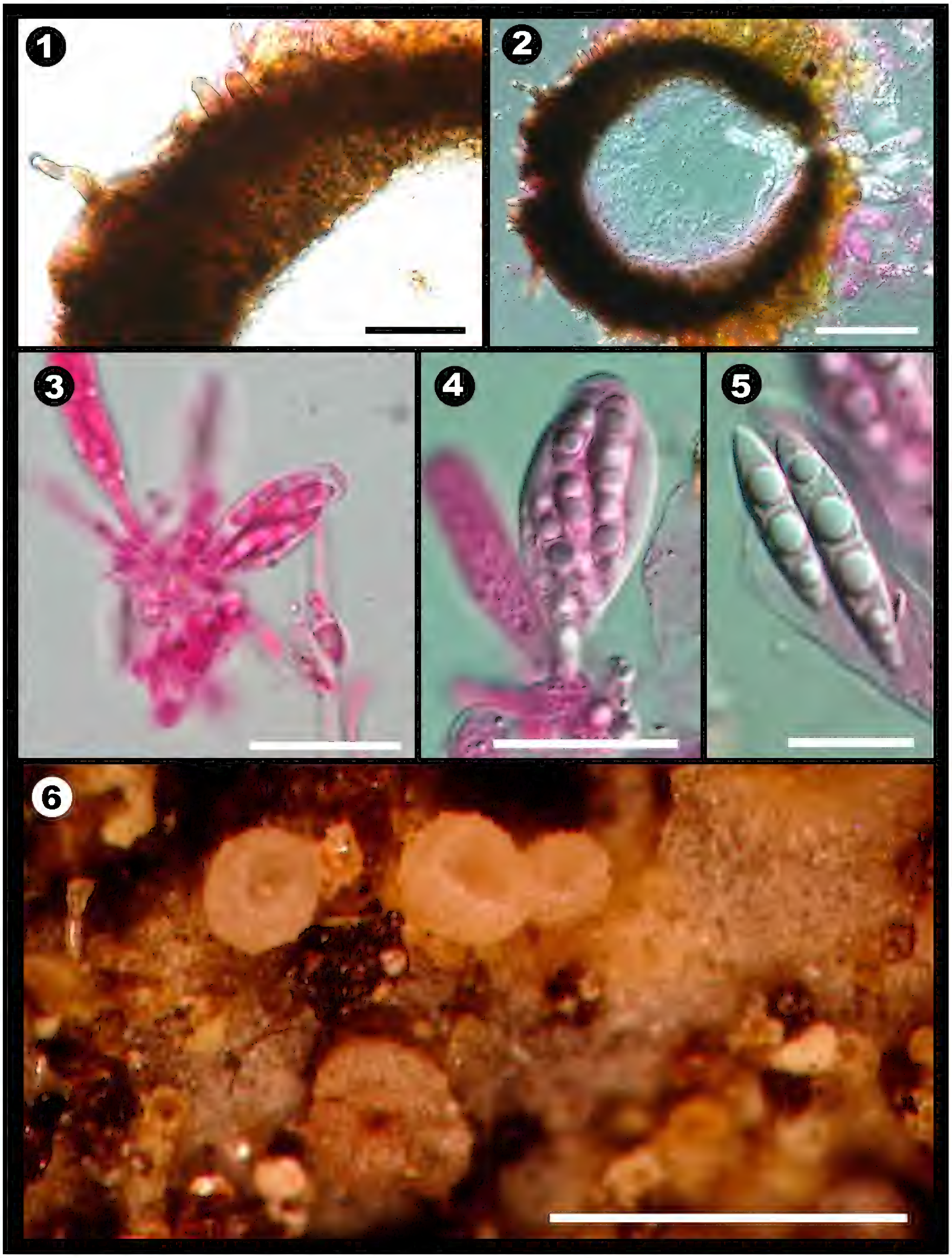

Plate 6. *Niesslia peltigericola* (*Lendemer 19680*). Figure 1, setae (scale = 20 µm). Figure 2, section of perithecium (scale = 50 µm). Figures 3 & 4, asci (scale = 20 µm). Figure 5, ascospores (scale = 10 µm). Figure 6, infection of *Pezizella epithallina* associated with small black perithecia of *N. peltigericola* (scale = 1 mm).

in the Czech Republic. Several other saxicolous *Lichenothelia* species have been reported as lichenicolous or fungicolous (Henssen 1987) and the recently described *L. renobalesiana* D. Hawksw. & V. Atienza (Atienza & Hawksworth 2008) is lichenicolous on calciphile *Verrucaria* species although it never forms an independent thallus. The saxicolous and lichenicolous *L. convexa* Henssen occurs in Europe and North America and Henssen collected it in California in Yosemite National Park, on Mt. Baldy in the San Gabriel Mountains, and in the Silver Lake area in San Diego County (Henssen 1987). It differs from *L. scopularia* especially in having a cellular hamathecium rather than pseudoparaphyses and an amyloid centrum.

Specimens Examined. – **USA: CALIFORNIA.** MARIPOSA CO.: Yosemite Valley, sine date, *H.N. Bolander 296* (FH); TUOLUMNE CO.: Yosemite National Park, above Old Oak Flat Road, 1 mile east of Hodgkin Meadow near Hazel Tree Creek, 37° 47’ 33” N 119° 50’ 50’ W, 1387 m, on boulder in understory of forest with *Aspicilia* species, 19.vi.2009, *K. Knudsen 11616* (UCR, hb. Yosemite NPS).

10. *Niesslia peltigericola* (D. Hawksw.) Etayo & Sancho

PLATE 6 (PAGE 117).

This taxon was originally described and illustrated by Hawksworth (1980) as *Wentiomyces peltigericola* D. Hawksw. Subsequently it was transferred to *Raciborskiomyces* Siemaszko by Barr (1997). Etayo and Sancho (2008) again reappraised the taxon and transferred it to *Niesslia* Auersw. Diederich (2003) reported the species for the first time from North America (Washington) on *Peltigera britannica* (Gyeln.) Holt.-Hartw. & Tønsberg. During our foray in Yosemite National Park we unexpectedly found this, and the following lichenicolous species, on a thallus of *Peltigera didactyla* (With.) J.R. Laundon growing near a stream at the base of a marble outcrop in the high country. This appears to be only the second known report of *N. peltigericola* from North America. It can be recognized by its small black setose perithecia, asci with a distinct refractive apical ring, and hyaline 1-septate ascospores (12-16 x 3.5-4.5 µm).

Specimen Examined. – **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite National Park, Mount Hoffman Marble outcrops, upper marble mound, 2652 m., 21.ix.2009, on *Peltigera didactyla* on soil along stream, *J.C. Lendemer 19680* (NY).

11. *Pezizella epithallina* (Phill. & Plowr.) Sacc.

PLATE 6, FIGURE 6 (PAGE 117).

While studying the specimen of *Niesslia peltigericola* reported above we found that it consisted of an admixture with *Pezizella epithallina*, another taxon newly reported from North America by Diederich (2003) on the basis of a collection from New York. Our record seems to be the first report of this species from western North America. The taxon is easily identified using the key provided by Diederich and Etayo (2000) because of its minute translucent marginate apothecia, small hyaline simple ascospores ([7]–8–10–[12] x 2–3–[3.5] µm according to Hawksworth (1980)), and asci that have an I+ blue apical ring.

Specimen Examined. – **U.S.A. CALIFORNIA.** MARIPOSA CO.: Yosemite National Park, Mount Hoffman Marble outcrops, upper marble mound, 2652 m., 21.ix.2009, on *Peltigera didactyla* on soil along stream, *J.C. Lendemer 19680-A* (NY).

ACKNOWLEDGEMENTS

We thank Ulf Arup and Shirley Tucker for reviewing the manuscript. Thanks also to Bruce McCune and Martin Hutten for involving us in the Yosemite Lichen Blitz. Richard Harris aided in the preparation of several illustrations, identified the specimen of *Niesslia peltigericola*, and provided helpful discussion of several nomenclatural problems. Michaela Schmull is thanked for her help locating specimens at FH.

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Opuscula Philolichenum, **8**: 121-129. 2010.

Lichens of Eastern North America Exsiccati, Fascicle VIII, Nos. 351-400

James C. Lendemer[1]

ABSTRACT. – Data for the eighth fascicle, comprising the nos. 351 to 400, of *Lichens of Eastern North America Exsiccati* is presented. This fascicle of the exsiccat is distributed on exchange from The New York Botanical Garden to B, BG, CANB, CHR, FH, GZU, H, HMAS, KANU, LD, M, MIN, S, TNS, TU, UPS and hb. Kalb. The primary set resides at NY.

Introduction

In conjunction with the author's work on the lichen biota of eastern North America he began the distribution of this exisccat (*Lichens of Eastern North America Exsiccati*) from the Academy of Natural Sciences of Philadelphia (PH). This, the eighth fascicle in the series is distributed from the New York Botanical Garden (NY) where the author is now employed. This fascicle comprises the nos. 351-400, and is distributed in 20 sets on exchange to the following herbaria: B, BG, CANB, CHR, FH, GZU, H, HMAS, KANU, LD, M, MIN, S, TNS, TU, UPS and hb. Kalb. The primary set resides at NY.

Fascicle viii – Nos. 351-400

351. *Arthonia rubrocincta* G. Merr. *ex* R.C. Harris, Grube, and Lendemer
Det. J.C. Lendemer, 2009

ISOTYPE

UNITED STATES OF AMERICA. FLORIDA. COLLIER CO.: Fakahatchee Strand State Preserve, vicinity of Ranger Station. – Lat. 25° 57' 03" N, Long. 81° 21' 38" W – Disturbed roadside vegetation and shaded swampy hardwood forest. – On petioles of *Sabal palmetto*.

James C. Lendemer **#15506** 4.March.2009

352. *Lecanora munzii* K. Knudsen, Lendemer & Elix
Det. K. Knudsen, 2009

ISOTYPE

UNITED STATES OF AMERICA. CALIFORNIA. LOS ANGELES COUNTY.: Cismontane Valley, Claremont, Bernard Biological Field Station, back area, Ontario Quad. – elev. 1371 ft. – Lat. 34° 06' 58" N, Long. 117° 42' 15" W – Riversidean sage scrub. – On dead wood of senescent *Artemisia californica* laying on ground.

Kerry Knudsen **#10932** 26.April.2009
w/ Nancy Hamlett

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353. *Hypogymnia mollis* Pike & Hale
Det. K. Knudsen, 2009

UNITED STATES OF AMERICA. CALIFORNIA. SAN LUIS OBISPO COUNTY.: Central Coast, Los Osos, stabilized dunes, state park property on N-slope above riparian woodland, E of South Bay Blvd., Morro Bay South Quad. – elev. 62 ft. – Lat. 35˚ 19' 41" N, Long. 120˚ 49' 01" W – Dune shrubs. – On *Salvia mellifera*.

Kerry Knudsen **#11084** 13.May.2009

354. *Hypogymnia minilobata* McCune & Schoch
Det. K. Knudsen, 2009

UNITED STATES OF AMERICA. CALIFORNIA. SAN LUIS OBISPO COUNTY.: Central Coast, Los Osos, stabilized dunes, state park property E of South Bay Blvd., Morro Bay South Quad. – elev. 69 ft. – Lat. 35˚ 19' 39" N, Long. 120˚ 49' 09 W – Dune shrubs. – On *Prunus fasciculatus* var. *punctata*.

Kerry Knudsen **#11082** 13.May.2009

355. *Punctelia caseana* Lendemer & Hodkinson
Det. J.C. Lendemer, 2009

MORPHOTYPE II

UNITED STATES OF AMERICA. PENNSYLVANIA. TIOGA COUNTY.: Tioga State Forest, slopes above junction of US 15/I-99 and SR 2023 (Lower Arnot Rd.), ~2.5 mi S of Arnot. - elev. 1900 ft – Lat. 41° 37' 50"N, Long. 77° 07' 00"W – Ruderal hardwood forest (*Acer, Betula*) with extensive sandstone ledges. – On *Acer*.

James C. Lendemer **#16512** 12.May.2009
w/ Daniel Atha

356. *Punctelia caseana* Lendemer & Hodkinson
Det. J.C. Lendemer, 2009

MORPHOTYPE I

UNITED STATES OF AMERICA. PENNSYLVANIA. TIOGA COUNTY.: Tioga State Forest, west rim of Pine Creek Gorge, vicinity of Barbour Rock. - elev. ~1800 ft – Lat. 41° 43' 30"N, Long. 77° 26' 45"W – Calcareous sandstone bluffs with *Quercus-Pinus* forest.

James C. Lendemer **#16695** 13.May.2009

357. *Cladonia piedmontensis* G. Merr.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. LANCASTER COUNTY.: New Texas Serpentine Barren, N of Black Baron Rd., 1.5 mi W of jct with US 222, 0.75 mi E of Pleasant Grove. – Lat. 39° 44' 30"N, Long. 76° 11' 00"W – Serpentine barren with pine (*Pinus*) - oak (*Quercus*) - juniper (*Juniperus*) forest. – On humus.

James C. Lendemer **#17876** 26.May.2009

358. *Caloplaca* sp.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. YORK COUNTY.: W-shore of Susquehanna River, along River Rd. 0.7 mi N of PA 372. – Lat. 39° 49' 00"N, Long. 76° 20' 10"W – Periodically submerged schist outcrops in/along river. – On rock.

James C. Lendemer **#17970** 27.May.2009

359. *Leptogium lichenoides* (L.) Zahlbr.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. TIOGA COUNTY.: Tioga State Forest, E shore of Gleason Hollow Run at confluence with Fahneystock Run, along SR 3001 ~2.5 mi S of Leetonia. - elev. ~900 ft – Lat. 41° 34' 50"N, Long. 77° 28' 00"W – Calcareous sandstone ledges and overhangs along stream. – On rock ledges and moss cushions along stream.

James C. Lendemer **#16946** 14.May.2009

360. *Fuscidea arcuatula* (Arn.) V. Wirth & Vězda
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. CARBON COUNTY.: State Game Lands No. 129, E of PA 901, ~1 mi W of Dilldown Creek, ~2 mi N of Albrightsville. – Lat. 41° 02' 10"N, Long. 75° 34' 55"W – Rocky oak (*Quercus*) - maple (*Acer*) forest. – On boulders in shade.

James C. Lendemer **#17493** 19.May.2009
w/ Richard C. Harris

361. *Placynthium nigrum* (Huds.) Gray
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. TIOGA COUNTY.: Tioga State Forest, E shore of Gleason Hollow Run at confluence with Fahneystock Run, along SR 3001 ~2.5 mi S of Leetonia. - elev. ~900 ft – Lat. 41° 34' 50"N, Long. 77° 28' 00"W – Calcareous sandstone ledges and overhangs along stream. – On sandstone ledges along stream.

James C. Lendemer **#16941** 14.May.2009

362. *Rhizocarpon lavatum* (Fr.) Hazsl.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. LYCOMING COUNTY.: Tiadaghton State Forest, S-facing slopes above Rock Run, along Rock Run Rd. ~2 mi E of PA 14/town of Ralston. - elev. ~900 ft – Lat. 41° 31' 00"N, Long. 76° 54' 50"W – Bedrock outcrops along stream and mature mixed hardwood forest (*Fraxinus, Carya,* sparse *Acer*). – On sandstone ledges along stream.

James C. Lendemer **#16618** 12.May.2009
w/ Daniel Atha

363. *Pertusaria multipunctoides* Dibben
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. LYCOMING COUNTY.: Tioga State Forest, Algerine Swamp Natural Area, S-facing slopes above Gamble Run, along Gamble Run Rd. ~2.5 mi N of jct with PA 414. - elev. ~1800-1900 ft – Lat. 41° 31' 25"N, Long. 77° 28' 45"W – Rocky oak (*Quercus*) forest with *Cornus* understory. – On bark of large *Quercus* along road.

James C. Lendemer **#16954** 14.May.2009

364. *Absconditella lignicola* Vězda & Pišút
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. LYCOMING COUNTY.: Tiadaghton State Forest, S-facing slopes above Rock Run, along Rock Run Rd. ~2 mi E of PA 14/town of Ralston. - elev. ~900 ft – Lat. 41° 31' 00"N, Long. 76° 54' 50"W – Bedrock outcrops along stream and mature mixed hardwood forest (*Fraxinus, Carya,* sparse *Acer*). – On large old log.

James C. Lendemer **#16617** 12.May.2009
w/ Daniel Atha

365. *Cladonia atlantica* A. Evans
Det. R.C. Harris, 2009

UNITED STATES OF AMERICA. DELAWARE. NEW CASTLE COUNTY.: 3 mi SW of Townsend, along Golts Rd. – Woods. – On soil.

Clyde F. Reed **#62186** 25.May.1963

366. *Rinodina subminuta* H. Magn.
Det. R.C. Harris, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. TIOGA COUNTY.: Tioga State Forest, E shore of Gleason Hollow Run at confluence with Fahneystock Run, along SR 3001 ~2.5 mi S of Leetonia. - elev. ~900 ft – Lat. 41° 34' 50"N, Long. 77° 28' 00"W – Calcareous sandstone ledges and overhangs along stream. – On branches of *Juglans.*

James C. Lendemer **#16100** 14.May.2009

367. *Candelariella xanthostigma* (Ach.) Lettau
Det. James C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. PIKE COUNTY.: State Game Lands No. 209, terminus of Pond Eddy / Firetower Rd., 0.5 mi N of firetower. – Lat. 41° 23'' 50"N, Long. 74° 50' 00"W – Rocky mixed hardwoods (*Carya, Acer, Betula, Quercus*). – On large old *Quercus.*

James C. Lendemer **#18648** 28.July.2009

368. *Arthonia quintaria* Nyl.
Det. James C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. LANCASTER COUNTY.: NE corner of intersection of Scalpy Hollow Rd. and River Rd., E slopes above Fishing Creek, 2.25 mi W of intersection of Scalpy Hollow Rd. and PA 272. – Lat. 39° 49'' 50"N, Long. 76° 15' 50"W – Massive schist outcrops in oak (*Quercus*) forest with *Rhododendron* understory. – On branches fallen from the canopy.

James C. Lendemer **#18739** 29.July.2009

369. *Usnea subfusca* Stirton
Det. James C. Lendemer, 2009

UNITED STATES OF AMERICA. NORTH CAROLINA. HAYWOOD COUNTY.: Great Smoky Mountains National Park, E slopes above (E of) Caldwell Fork, along E portions of Boogerman Loop Trail. – Lat. 35° 36'' 20"N, Long. 83° 05' 50"W / Lat. 35° 37'' 30"N, Long. 83° 05' 30"W – elev. 3000-3600 ft. – Mixed rich cove forest and old homesteads with *Acer saccharum, Tsuga canadensis, Liriodendron,* and *Hamamelis* grading to upland *Carya, Quercus montana*, mature *Liriodendron* forest with *Rhododendron* understory. – On fallen branch.

Erin A. Tripp **#619** 4.August.2009
w/ James C. Lendemer

370. *Arthonia helvola* (Nyl.) Nyl.
Det. James C. Lendemer, 2009

UNITED STATES OF AMERICA. PENNSYLVANIA. WAYNE COUNTY.: State Game Lands No. 312, S end of Lehigh Pond. – Lat. 41° 15'' 30"N, Long. 75° 25' 10"W – *Larix-Picea-Acer* bog with adjacent *Tsuga-Acer-Betula-Fagus* forest. – On base of large *Betula.*

James C. Lendemer **#18581** 27.July.2009

371. *Normandina pulchella* (Borrer) Nyl.
Det. James C. Lendemer, 2009

UNITED STATES OF AMERICA. NORTH CAROLINA. SWAIN COUNTY.: Great Smoky Mountains National Park, Beech Gap Trail between Straight Fork Rd./Balsam Mountain Rd. and Hyatt Ridge Trail. – Lat. 35° 37'' 25"N, Long. 83° 12' 45"W to Lat. 35° 37'' 50"N, Long. 83° 14' 00"W – elev. ca. 3200-4900 ft. – Rich hardwood forest and granitic overhangs with *Acer saccharum, Betula nigra, Betula alleghaniensis, Quercus coccinea, Fagus,* and *Halesia*. – Covering [!] the trunk of fallen *Robinia*.

James C. Lendemer **#19201** 6.August.2009
w/ Erin A. Tripp

372. *Placynthiella dasaea* (Stirton) Tønsberg
Det. James C. Lendemer, 2009

UNITED STATES OF AMERICA. MARYLAND. CECIL COUNTY.: Elk Neck State Forest, Black Hill Tract, Black Hill 0-1 mi S of McKinneytown Rd. – Lat. 39° 32' 10" N, Long. 75° 36' 20" W – Ruderal *Liquidambar-Quercus-Acer* forest. – On humus of road bank.

James C. Lendemer **#19989** 30.November.2009

373. *Chrysothrix chamaecyparicola* Lendemer
Det. J.C. Lendemer, 2009

ISOTYPE

UNITED STATES OF AMERICA. NORTH CAROLINA. CAMDEN COUNTY.: Dismal Swamp State Park, S side of Kim Saunders Ditch, at 5 mi marker. – Lat. 36° 32' 00"N, Long. 76° 28' 00"W – Atlantic white cedar (*Chamaecyparis thyoides*) stand with blow-downs and mixed hardwoods (*Magnolia, Acer, Nyssa*). – On *Chamacyparis*.

James C. Lendemer **#20207** 10.December.2009
w/ Signa Williams

374. *Cryptothecia evergladensis* Seavey
Det. Richard C. Harris, 2010

TOPOTYPE

UNITED STATES OF AMERICA. FLORIDA. [MIAMI-]DADE COUNTY.: Everglades National Park, northeast of Pay-hay-okee Overlook. – Cypress domes and bayheads in dwarf cypress. – On trunk of *Taxodium*.

Richard C. Harris **#2838** 13.May.1967

375. *Ramonia microspora* Vězda
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. CANDLER COUNTY.: Fifteenmile Creek Preserve, E side of Fifteenmile Creek just S of I-16. – Lat. 32° 21' 41"N, Long. 82° 01' 57"W – Mesic hardwood forest (*Ilex, Nyssa, Fagus, Acer, Querucs*) with pine (*Pinus*) and cypress (*Taxodium*) on bluff. – On *Quercus*.

James C. Lendemer **#21693** 22.December.2009
w/ Sean Q. Beeching & Malcolm Hodges

376. *Piccolia nannaria* (Tuck.) Lendemer & Beeching
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. CANDLER COUNTY.: Fifteenmile Creek Preserve, uplands above E shore of Fifteenmile Creek. – Lat. 32° 21' 37"N, Long. 82° 01' 41"W – Oak (*Quercus*) scrub on sand hill. – On *Quercus* branch.

James C. Lendemer **#21632** 22.December.2009
w/ Sean Q. Beeching & Malcolm Hodges

377. *Parmeliella appalachensis* P.M. Jørg. s. str.
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. NORTH CAROLINA. JACKSON COUNTY: Nantahala National Forest, Panthertown Valley, Blue Ridge between Cold Mountain Gap and Panthertown Creek, Big Ridge Quad. – elev. 3800-4000 ft. – Lat. 35° 09' 09" N, 83° 00' 41" W – Mixed hardwood (*Acer, Quercus, Carya, Juglans, Nyssa*) on north-west facing slope, with several small streams. – On *Acer*.

James C. Lendemer **#21786** 29.April.2006

378. *Parmotrema perforatum* (Jacq.) A. Massal.
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. VIRGINIA. CHESAPEAKE CITY: Dismal Swamp National Wildlife Refuge, E of Laurel Ditch, ½ mi N of jct with Persimmon Ditch. – Lat. 36° 35' 00" N, 76° 24' 50" W – Mixed hardwood (*Acer, Ilex*) swamp forest. – On fallen *Quercus*

James C. Lendemer **#20576** 13.December.2009
w/ Brendan P. Hodkinson & Signa Williams

379. *Dirinaria aegialita* (Afzel. *ex* Ach.) B.J. Moore
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island, Sapelo Island Wildlife Management Area, Middle Rd. 0.25 mi S of jct. with Rogers Marsh Rd. – Lat. 31° 27' 00" N, 81° 15' 50" W – Oak (*Quercus*) forest. – On the base of an oak (*Quercus*).

James C. Lendemer **#20920** 16.December.2009

380. *Arthonia subdiffusa* Willey
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island, Sapelo Island Wildlife Mangement Area, West Perimeter Rd. 0.5 mi N of Kenan Fields. – Lat. 31° 27' 27" N, 81° 16' 00" W – Maritime forest / wetland with old palmetto (*Sabal*) and juniper (*Juniperus*), with adjacent forest of large oaks (*Quercus*). – On old *Sabal* petioles.

James C. Lendemer **#20837** 16.December.2009

381. *Canoparmelia cryptochlorophaea* (Hale) Elix & Hale
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island, Sapelo Island Wildlife Management Area, Dogpatch Rd., 3/4 mi E of Lumber Landing. – Lat. 31° 27' 00" N, 81° 15' 50" W – Mixed hardwood forest (*Ilex, Liquidambar, Quercus*) with pine (*Pinus*) and palmetto (*Sabal*). – On large fallen *Quercus*.

James C. Lendemer **#20609** 15.December.2009

382. *Cladonia sandstedei* Abbayes
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. EMANUEL COUNTY: Ohoopee Dunes Natural Area, McLeod Bridge Tract, old unpaved road 0.5 mi W of intersection of McLeod Bridge Rd. and Old McLeod Bridge Rd., E shore of Little Ohoopee River. – Lat. 32° 36' 10" N, 82° 25' 45" W – Oak (*Quercus*) scrub grading to mixed hardwood (*Acer, Liquidambar, Ilex, Quercus*) floodplain. – On sand.

James C. Lendemer **#21281** 19.December.2009

383. *Lepraria aurescens* Orange & Wolseley
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. FLORIDA. ST. JOHNS COUNTY: South Point Vedra Beach, Guana Tolomato Matanzas National Estuarine Research Reserve, along Purple (Timucuan) Trail. – Lat. 30° 01' 15" N, 81° 20' 03" W – Oak-dominated forest. – On bark of oak.

William R. Buck **#54370** 28.November.2008

384. *Gyalideopsis submonospora* Lücking & W.R. Buck
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island, Sapelo Island Wildlife Management Area, Middle Rd. 0.25 mi S of jct. with Rogers Marsh Rd. – Lat. 31° 27' 00" N, 81° 15' 50" W – Oak (*Quercus*) forest. – On wood of large old weathered oak (*Quercus*) logs.

James C. Lendemer **#20925** 16.December.2009

385. *Enterographa anguinella* (Nyl.) Redinger
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island, Sapelo Island Wildlife Management Area, behind Nanny Goat Beach. – Lat. 31° 23' 20" N, 81° 15' 45" W – Maritime forest dominated by juniper (*Juniperus*) and shrubs. – On woody vines sheltered under large junipers (*Juniperus*).

James C. Lendemer **#20781** 15.December.2009

386. *Hypocenomyce anthracophila* (Nyl.) P. James & G. Schneid.
Det. James C. Lendemer, 2010

FERTILE

UNITED STATES OF AMERICA. GEORGIA. EMANUEL COUNTY: Ohoopee Dunes Natural Area, GA80 Tract, 0.25-0.5 mi N of GA 80. – Lat. 32° 34' 30" N, 82° 27' 00" W – Oak (*Quercus*) scrub on white sand dunes surrounded by pine (*Pinus*) with occasional hardwoods (*Acer, Prunus*). – On pine (*Pinus*).

James C. Lendemer **#21273** 19.December.2009

387. *Opegrapha corticola* Coppins & P. James
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island, Sapelo Island Wildlife Management Area, Dogpatch Rd., 3/4 mi E of Lumber Landing. – Lat. 31° 27' 00" N, 81° 15' 50" W – Mixed hardwood forest (*Ilex, Liquidambar, Quercus*) with pine (*Pinus*) and palmetto (*Sabal*). – On dead *Liquidambar*.

James C. Lendemer **#20658-A** 15.December.2009

388. *Schismatomma rappii* (Zahlbr.) R.C. Harris
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island Wildlife Management Area, Cabretta Island, vicinity of entrance to Cabretta Beach. – Lat. 31° 26' 00" N, 81° 14' 10" W – Oak (*Quercus*) - juniper (*Juniperus*) maritime forest. – On oak (*Quercus*).

James C. Lendemer **#20995** 16.December.2009

389. *Clathroporina isidiifera* R.C. Harris
Det. Richard C. Harris, 2010

UNITED STATES OF AMERICA. NORTH CAROLINA. HAYWOOD COUNTY: Great Smoky Mountains National Park, 3 miles SE of Waterville, along Baxter Creek Trail, S of Big Creek Campsite Mount Sterling Ridge, lower slopes of Mount Sterling, Cove Creek Quad. – Lat. 35° 44’ 12” N, 83° 06’ 36” W – Rich cove forest (*Aesculus, Acer, Liriodendron, Betula, Halesia*) on N-facing slope with narrow rocky ravine of Baxter Creek. – On large shaded boulders.

James C. Lendemer **#8085** 28.October.2006
w/ Erin A. Tripp

390. *Bacidia heterochroa* (Müll. Arg.) Zahlbr.
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island, Sapelo Island Wildlife Management Area, behind Nanny Goat Beach. – Lat. 31° 23’ 20” N, 81° 15’ 45” W – Maritime forest dominated by juniper (*Juniperus*) and shrubs. – On branches of *Juniperus*.

James C. Lendemer **#20782** 15.December.2009

391. *Amandinea submonatana* Marbach
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. McINTOSH COUNTY: Sapelo Island Wildlife Management Area, Cabretta Island, vicinity of entrance to Cabretta Beach. – Lat. 31° 26’ 00” N, 81° 14’ 10” W – Oak (*Quercus*) - juniper (*Juniperus*) maritime forest. – On old *Juniperus* wood.

James C. Lendemer **#20991** 16.December.2009

392. *Buellia wheeleri* R.C. Harris
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. GEORGIA. BURKE COUNTY: Boggy Gut Creek tract, N of GA 56 Spur (River Road), ca. 3 mi E of GA 56 at McBean. – elev. ca. 50 m. – Lat. 33° 13’ 56” N, 81° 51’ 17.5” W – Mesic oak-pine woodland on sandhill. – On large *Quercus*.

James C. Lendemer **#22295** 15.March.2010

393. *Canoparmelia texana* (Tuck.) Elix & Hale
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. SOUTH CAROLINA. AIKEN COUNTY: Savannah River Bluffs Heritage Preserve, SW of old Plantation Road, ca. 1 mi SW of I-20 and GA 230 intersection. – elev. ca. 80 m. – Lat. 33° 31’ 37” N, 82° 00’ 22” W – Mesic mixed hardwood bluff forest with felsic/mafic outcrops. – On fallen *Acer*.

James C. Lendemer **#22044** 13.March.2010

394. *Buellia mamillana* (Tuck.) W.A. Weber
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. SOUTH CAROLINA. AIKEN COUNTY: Savannah River Bluffs Heritage Preserve, SW of old Plantation Road, ca. 1 mi SW of I-20 and GA 230 intersection. – elev. ca. 80 m. – Lat. 33° 31’ 37” N, 82° 00’ 22” W – Mesic mixed hardwood bluff forest with felsic/mafic outcrops. – On rock outcrops along river.

James C. Lendemer **#22043** 13.March.2010

395. *Parmotrema mellissii* (C.W. Dodge) Hale
Det. James C. Lendemer, 2010

UNITED STATES OF AMERICA. SOUTH CAROLINA. AIKEN COUNTY: The Hitchcock Woods, just SW of city of Aiken, along Tea Cottage Path from entrance on Dibble Road to Chalk Cliffs. – elev. ca. 115 m. – Lat. 33° 33' 12" N, 81° 45' 20" W – Mixed pine-oak-*Kalmia latifolia* mesic sandhill woodland. – On *Kalmia*.

James C. Lendemer **#22080** 14.March.2010

396. *Psorula rufonigra* (Tuck.) Gotth. Schneid.
Det. J.C. Lendemer & R.C. Harris, 2010

UNITED STATES OF AMERICA. GEORGIA. COLUMBIA COUNTY: Burks Mountain, ca. 3.5 mi E of US 221 from Pollards Corner on road through Rosemont. – elev. ca. 130 m. – Lat. 33° 37' 07" N, 82° 13' 09" W – Mixed pine-scrub oak serpentinite woodland. – On *Spilonema revertens*, on large boulders.

James C. Lendemer **#22042** 12.March.2010

397. *Porina scabrida* R.C. Harris
Det. R.C. Harris, 2010

UNITED STATES OF AMERICA. SOUTH CAROLINA. AIKEN COUNTY: Savannah River Bluffs Heritage Preserve, SW of old Plantation Road, ca. 1 mi SW of I-20 and GA 230 intersection. – elev. ca. 80 m. – Lat. 33° 31' 37" N, 82° 00' 22" W – Mesic mixed hardwood bluff forest with felsic/mafic outcrops. – On *Carya* and *Quercus* along stream.

James C. Lendemer **#21939** 13.March.2010

398. *Cladonia corymbites* Nyl.
Det. J.C. Lendemer & R.C. Harris, 2010

CUBA. ORIENTE: around summit of San Juan, Loma del Gato, Sierra Maestra. – Montane thicket with huge boulders and cliffs. – On soil.

Henry A. Imshaug **#24604** 12.August.1959

399. *Cladonia scabriuscula* (Delise) Leight.
Conf. J.C. Lendemer & R.C. Harris, 2010

HAITI. DEPT. DE L'OUEST: road from Foret des Pins to Savane-Zombie. – elev. 5300 ft. – Montane thicket.

Clifford M. Wetmore **#3000** 15.July.1958
w/ Henry A. Imshaug

400. *Cladonia furcata* (Huds.) Schrad.
Det. J.C. Lendemer & R.C. Harris, 2010

DOMINICAN REPUBLIC: summit of Pico Trujillo, Cordillera Central, Maciso Central, Sierra de la Pelonia, - elev. 10,000 ft. – Pine woodland.

Henry A. Imshaug **#23512** 9.August.1958
w/ Clifford M. Wetmore

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Opuscula Philolichenum, **8**: 131-139. 2010.

Lichenicolous fungi from the western Pyrenees. V. Three new ascomycetes.

Javier Etayo[1]

ABSTRACT. – Three new species of lichenicolous fungi are described on epiphytic lichens from northern Spain: *Cercidospora anomala* on *Pertusaria pertusa*, *Cornutispora pyramidalis* on *Hypotrachyna* and *Parmotrema* (also from the Azores) and *Nectriopsis hirta* on *Pertusaria albescens*, *P. pertusa* and an unidentified sterile lichen.

KEYWORDS. – Ascomycotina, coelomycetes, Basque Country.

Introduction

Many species of lichenicolous fungi have been described in recent times from the western Spanish Pyrenees, including Navarre and the Basque Country, by the author alone or together with other colleagues showing the area to be very interesting for both lichens and lichenicolous fungi. The present contribution is a continuation of the series of papers by Etayo and Diederich (1995, 1996a, 1996b, 1998) and Etayo and Breuss (1996) on some lichenicolous from France and Spain, and forms part of the research of the author in the Basque country (northern Spain) with the final goal to prepare a catalogue for the region that is as complete as possible.

For the contribution presented here three species of lichenicolous fungi have been studied by the author all being new to science. The first, *Cercidospora anomala*, is compared with other lichenicolous members of *Cercidospora* Körb. Following the database Index Fungorum (2010), 153 species of fungi have been described or combined in *Cercidospora* so far. Many of them are synonyms of other species, even in other genera, and only about 28 are lichenicolous. A key of these lichenicolous species was published by Zhurbenko and Triebel (2003). As the name of the new species points out, the spores of *C. anomala* are very different from those of most of the other species of the genus.

The second new taxon, *Cornutispora pyramidalis*, is not conspecific with any of the six out of the seven species recognized in *Cornutispora* Piroz. by Punithalingham (2003). The recently described species *C. herteliana* Knoph (Knoph 2004) is also different to *C. pyramidalis,* which is unique in its pyramidal conidia.

The third new taxon is a nectrioid fungus that was found on *Pertusaria* and an unidentified sterile crustose lichen. Since Samuels (1988) redefined the features of the nectrioid genus *Nectriopsis* Maire, many lichenicolous species have been added to this genus. Presently Index Fungorum (2010) records 68 species and the new *N. hirta* differs from all of these by its very hairy, pinkish brown perithecia and large ascospores.

Materials and Methods

Specimens were studied using standard microscopical techniques. Hand made sections were studied in water, concentrated nitric acid (N) and 10% KOH [K]. Amyloid reactions were tested in Lugol's iodine [I] with and without pre-treatment with KOH [K/I]. Ascospore measurements were made in water. Macro- and micro- photographs were taken with a digital camera Olympus Coolpix 5200 on a MEIJI stereomicroscope (up to ×45) and Olympus CH (up to ×1000).

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THE SPECIES

1. *Cercidospora anomala* Etayo sp. nov.

Mycobank #518234.

PLATE 1 (PAGE 133).

> Fungus lichenicola in thallis *Pertusariae pertusae* crescens. Ascomata perithecioidea, pyriformia vel globosa, 120-180 µm diam., immersa vel erumpentia; peridium hyalinum vel viride. Filamenta interascalia ramosa, 1.5-2 µm crassa. Asci fissitunicati, clavati, 95-115 x 20-28 µm, (2-)4-spori. Ascosporae hyalinae, simplices, late ellipsoideae, (22-)28-32 x 15-26 µm.
>
> TYPE: **SPAIN:** Basque Country, Gipuzkoa, Oiartzun, Oieleku Fagus-wood, Lot 5, 43°14'S, 1°49'W, on *Pertusaria pertusa* on bark of *Fagus sylvatica,* 22.viii.2006*, J. Etayo 23409* (VIT-holotypus, hb. Etayo-isotypus).

DESCRIPTION. – Ascomata perithecioid, pyriform to globose, greenish-black, dispersed, first immersed later breaking through the host cortex to become erumpent, 120-180 µm in diam., with central ostiole. Mycelium immersed, hyaline. Ascomata wall of 15-20 µm thickness, hyphal, formed by thin walled hyphae of 1-3 µm thick, emerald green in the upper part, pale to almost colourless in the lower part, K-, KI-, N+ violet (in green zones). Hymenial gel I-, KI-. Hamathecium of septate, branched paraphysoid-like interascal filaments, 1.5-2 µm thick, abundant, thin-walled, not swollen at the apices. Asci bitunicate, fissitunicate, claviform, stalked, ascal wall thickened in the apex, 95-115 x 20-28 µm, (2-)4-spored, I-, KI-, ascoplast I+ orange (dextrinoid reaction). Ascospores widely ellipsoidal, colourless, simple, with thin and smooth wall, without perispore visible in LM, with abundant, small, oil guttules, uniseriate, (22-)28-32 x 15-26 µm. Conidiomata not observed.

ETYMOLOGY. – The species name refers to the abnormal shape and lack of septation of the ascospores.

HABITAT AND DISTRIBUTION. – *Cercidospora anomala* is pathogenic and destroys the thalli and apothecia of *Pertusaria pertusa*. The infection causes a yellow brownish colour in the thallus that helps in recognizing it in the field. Ascomata are common but due to thallus degradation they usually remain only as small greenish or hyaline holes when they disappear. The species is common in the well preserved oceanic beech-wood of Oieleku (Gipuzkoa), where it has been collected in at least three places. It is not rare to find it without spores or with badly formed ones, although the hymenium is normally well developed.

DISCUSSION. – Zhurbenko and Triebel (2003) made a compilation of species of *Cercidospora* known at that time. Later the number was increased by other authors (e.g., Navarro-Rosinés et al. 2004, 2009; Etayo & Boom 2005; Ihlen & Wedin 2007) to 28 species of lichenicolous *Cercidospora*, half of them with an arctic or boreal-alpine distribution. The hypothesis that the evolutionary centre of the group is the northern Holarctic (Zhurbenko & Triebel 2003) seems to be correct because none of the species of the genus were reported from southern South America by Etayo and Sancho (2008) and only one species has been reported from New Zealand (Hafellner & Mayrhofer 2007).

Cercidospora anomala has many features of the genus, such as the structure and colour of the perithecial wall as well as the type of paraphysoids and asci, but the spores are very atypical. Navarro-Rosinés et al. (2004) reported spores with one or more transversal septa, oval, ellipsoid or fusiform, strongly heteropolar in some taxa, but only rarely non-septate. *Cercidospora anomala* is the only known species with typically simple and widely ellipsoid spores. *Cercidospora lobothalliae* Nav.-Ros. & Calat. also produces simple spores, but they are (13-)16-21.5(24) x (4.5-)5-6 µm, with the typical long ellipsoid shape of many *Cercidospora* species. Curiously, the host, *Pertusaria pertusa* also has 2-4-spored asci but the spores are much larger and with a thicker wall. Furthermore other hymenial features and the ascus structure are very different in the host and the inhabiting lichenicolous fungus.

Etayo (2002a) described *Viridiannula pertusariae* on the same host in other nearly oceanic localities. The colour of the wall in this lichenicolous coelomycete is similar, which may indicate a possible

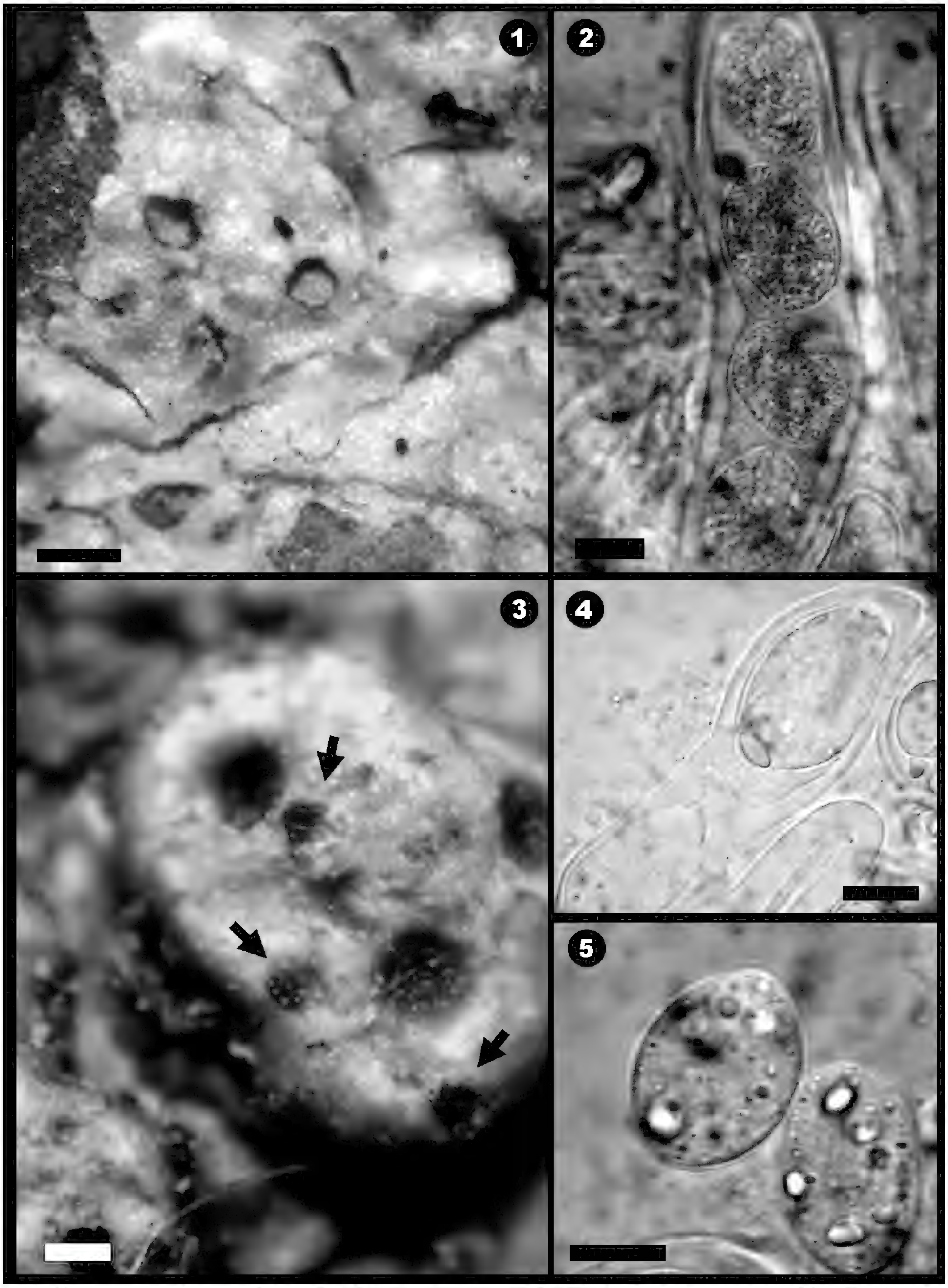

Plate 1. *Cercidospora anomala* (all from holotype). Figure 1, thallus of *Pertusaria pertusa* with two empty ascomata of the fungus (scale = 200 µm). Figure 3, ascomata of *P. pertusa* with several ascomata of *Cercidospora anomala* (arrows; scale = 100 µm). Figures 2 and 4, asci with spores (scale = 10 µm). Figure 5, ascospores (scale = 10 µm).

teleomorph-anamorph relation, but they have so far never been found growing intermixed on the same thallus or at the same locality.

ADDITIONAL SPECIMENS EXAMINED. – **SPAIN:** Gipuzkoa, Oiartzun, Oieleku *Fagus*-wood, Lot 1, on *Pertusaria pertusa*, on bark of *Fagus sylvatica*, 27.v.2006, *J. Etayo 23309* (hb. Etayo); Ibidem, Oieleku *Fagus*-wood, Lot 2, on *P. pertusa* on bark of *Fagus sylvatica,* 1.xi.2006, *J. Etayo 23502* (hb. Etayo).

2. *Cornutispora pyramidalis* Etayo sp. nov.

Mycobank #518235.

PLATE 2 (PAGE 135).

> Conidiomata pycnidia, immersa vel partim erumpentia, globosa, pallide rufa, 50-70 µm diam, ostiolata. Paries pycnidialis pseudoparenchymaticus supra rufa et infra hyalina. Conidiophora et cellulae conidiogenae difficiliter visibilia; Conidia holoblastica, hyalina, pyramidalia, aseptata, 4-5 µm lata.
>
> TYPE: **SPAIN:** Guipuzkoa, Peñas de Aia, way to Bianditz, 400-600 m, 43º16' N, 1º47' W, on *Hypotrachyna revoluta* on *Larix*, 3.vii.2008, *J. Etayo 24739* (VIT-holotypus, hb. Etayo-isotypus).

DESCRIPTION. – Infection symptoms are a bleaching of the thallus of *Hypotrachyna revoluta* and *Parmotrema*, and especially in this last species in forming circular areas surrounded by dark brown necrotic margins. Mycelium immersed, hyaline. Conidiomata pycnidial, immersed, becoming finally partially erumpent, cream coloured, globose, 50-70 µm diam opening to the exterior by a wide "ostiole" due to disintegration of the upper wall. Pycnidial wall paraplectenchymatic, composed of several layers of cells of yellowish brown colour on the top, hyaline at the base. Conidiophores and conidiogenous cells not clearly observed, even when young. Conidia holoblastic, colourless, aseptate, triangular or tetraedric, without a main conidial axis, the four angles without appendages, "pyramid-shape", thin-walled, about 4-5 µm from one apex to another, with small oil-guttules inside.

ETYMOLOGY. – The species name reflects the conidial shape of this species.

HABITAT AND DISTRIBUTION. – *Cornutispora pyramidalis* has been found in two oceanic woods, in Gipuzkoa (N Spain) and São Miguel (Azores), growing on Parmeliaceae (*Hypotrachyna revoluta* and *Parmotrema* sp.), on exotic trees (*Larix* and *Cryptomeria*). Degradation of the host thallus shows that it is a parasitic species. The black ring surrounding the infection is much more visible on *Parmotrema.*

DISCUSSION. – A recent study of the genus, including the distribution and behaviour of nuclei in the conidia, has been published by Punithalingam (2003). This author treated six species including one that is not strictly lichenicolous (*C. limaciformis* Piroz., the type of which grows on apothecia of *Therrya fuckelii*). This species has been recorded on *Lecanora (Protoparmeliopsis) muralis* by van den Boom & Etayo (2000), but the material might belong to *C. intermedia* Punith. & D. Hawksw., which was described several years later (Punithalingam 2003).

Cornutispora herteliana (Knoph 2004) was described from the apothecia and thalli of *Lecidella elaeochroma* s.l. in Japan. The drawings of the conidia are very similar to those of *C. intermedia* (Punithalingam 2003), but I have not studied that material.

Cornutispora lichenicola D. Hawksw. & B. Sutton is the most commonly recorded species of the genus. Although the holotype was growing on *Parmelia sulcata*, it has been collected on several unrelated hosts, most of them belonging to other genera of the Parmeliaceae, but also on genera such as *Cladonia, Haematomma, Hypocenomyce, Lecanora, Lobaria, Ochrolechia, Pertusaria, Phlyctis, Rhizoplaca* or *Rinodina* (Kocourková 2000). Although several of those records might belong to the recently described *C. intermedia* Punith. & D.Hawksw. (Punithalingam 2003), the type of which grows on *Ochrolechia*, it shows a lower host restriction for some species of the genus. So, with the exception of *C. triangularis* Diederich & Etayo, known only from *Pertusaria pertusa*, the remaining described lichenicolous species are not host specific, although they have a preference for Parmeliaceae hosts.

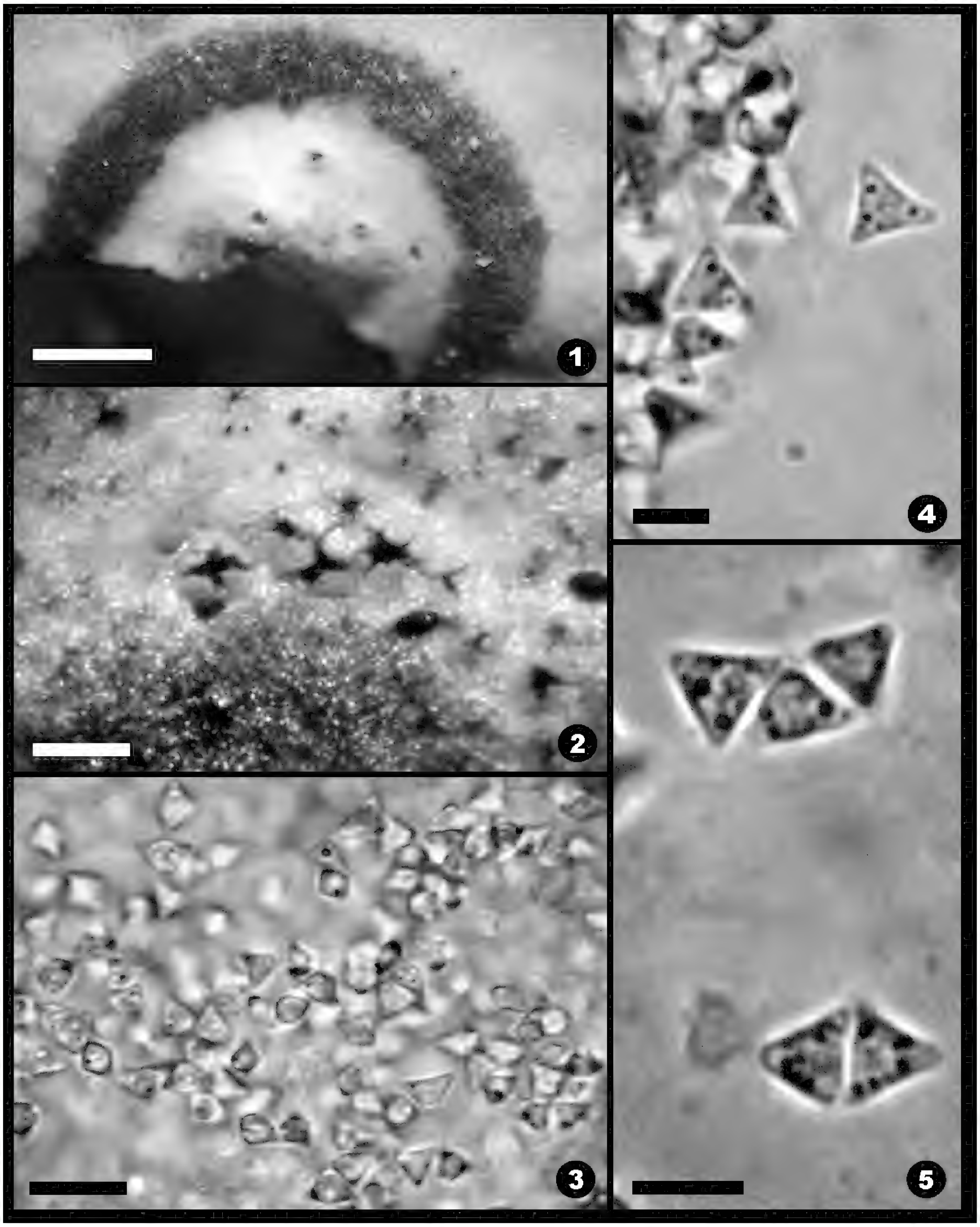

Plate 2. *Cornutispora pyramidalis*. Figure 1, thallus of *Parmotrema* with a necrotic zone due to the fungus (hb. Etayo 24103; scale = 1.0 mm). Figure 2, thallus of *Hypotrachyna revoluta* with several conidiomata (holotype; scale = 100 µm). Figures 3-5, pyramidal conidia (all from holotype; scale = 10 µm, 5µm, and 5µm respectively).

The conidia of *Cornutispora triangularis* Diederich & Etayo have a similar shape to those of the new species (Etayo & Diederich 1995), but they are much larger, 11-17 µm in diam., with deep incisions in the middle of each side of the triangle. *Cornutispora pittii* D.Hawksw. & Punith. (Punithalingam 2003), on the contrary, also has very small conidia but they are triradiate, typically "Y-shaped" and with the main conidial axis measuring 3-3.5 µm in length. This species is known on *Hypotrachyna formosana* from Australia (Punithalingam 2003).

ADDITIONAL SPECIMENS EXAMINED. – **PORTUGAL:** Azores, S. Miguel, Sete Ciudades, Lagoa verde, on *Parmotrema* sp., on *Cryptomeria japonica*, 140 m, 37°50'N, 25°47'W, 19,vii.2007, *J. Etayo 24103 & E. Ros* (hb. Etayo).

3. *Nectriopsis hirta* Etayo sp. nov.

Mycobank #518236.

PLATE 3 (PAGE 137).

Fungus lichenicola in thallis *Pertusariae albescentis* et *P. pertusae* crescens. Perithecia superficialia, subsphaerica, brunnea vel aurantio-brunnea, 200-300 µm diam.; pili hyalini, septati, 30-50 x 5-6 µm, capitati cum cellulis terminalibus 7-15 µm latis. Asci clavati, 6-8-spori, 50-55 x 10-12 µm. Ascosporae hyalinae, 1-septatae, laeves, 16-29 x 7.5-10.5 µm.

TYPE: **SPAIN:** Álava, Puerto de Herrera, way to San León, *Fagus*-wood and calcareous blocks near the transmitting aerial, 1100-1200 m, 42°35'46"N, 2°41'03"W, on *Pertusaria albescens* and *P. pertusa*, 23.ii.2009, *J. Etayo 25024* (VIT-holotypus, hb. Etayo-isotypus).

DESCRIPTION. – Lichenicolous on *Pertusaria*. Ascomata are perithecia, solitary to aggregated, superficial, subspherical, orange brownish to brown, collapsing upwards, 200-300 µm in diam., with abundant hairs on all the surface of perithecia; perithecial base with a web of hyaline hyphae (pinkish under the dissecting microscope or hand lenses) each of 5-6 µm thick; hairs orange, subhyaline at microscope, smooth, septate, thin-walled, not or hardly constricted in the septa, of 30-50 µm long and 5-6 µm wide, sometimes capitate at the apex forming roundish to pyriform cells of 7-15 µm wide; surface of the perithecial wall paraplechtenchymatic, with large cells of 10-17 µm diam.,1-1.5 µm thick wall; perithecial wall composed of several layers of cells, 30-60 µm thick, of orange colour towards the outside, with many orange oil guttules of 0.5-4 µm diam. and hyaline in the inner part. Ostiolar canal periphysate; periphyses simples 3-4 µm thick, with many small orange guttules. Paraphyses gelatinized at maturity, delicate when young with a very thin wall and 6-10 µm thick. Asci clavate, wider in central zone, with obtuse apex, of 50-55 x 10-12 µm. Ascospores 6-8/ascus, biseriate, ellipsoid to broadly ellipsoid, sometimes citriform and slightly mucronate, hyaline, at the medial septum not or slightly constricted, with many small hyaline guttules, orange when overmature, smooth, (0-)1-septate, 15-21 x 8-10.5 µm when simple, 16-29 x 7.5-10.5 µm when 1-septate.

ETYMOLOGY. – The term "hirta" refers to perithecium being entirely covered by hairs, more densely disposed than in most of the other lichenicolous species of the genus.

HABITAT AND DISTRIBUTION. – *Nectriopsis hirta* is locally abundant in the type locality area, a *Fagus* wood in northern Spain, where it was found growing on *Pertusaria pertusa* and, rarely on *P. albescens*. At another locality (Oieleku) we found a large specimen with hundreds of perithecia on a sterile unidentified crustose lichen growing on *Acer*. This sample is very similar to the type, but with spores being slightly smaller (14-19 x 7-9.5 µm). Study and comparison of further material is necessary to affirm whether one or two species are involved.

DISCUSSION. – The large ascospore size of the new species is similar to that of *Nectriopsis lichenophila* (Speg.) Etayo, a species that grows on *Heterodermia* in South America (Etayo 2002b), but that species has yellow orange perithecia, with longer, non capitate hairs (50-100 µm long), subcylindrical, 4-spored asci (70-80 x 7-10 µm), and spores with a typical acute apex that in general are narrower (18-28 x 6.5-8 µm) than those of *N. hirta*. *Nectriopsis indigens* (Arnold) Diederich & Schroers (Sérusiaux *et al.* 1999) has ascomata 150-250 µm, that are not hairy at the base, asci 70-85 x 14-18 µm and smaller spores

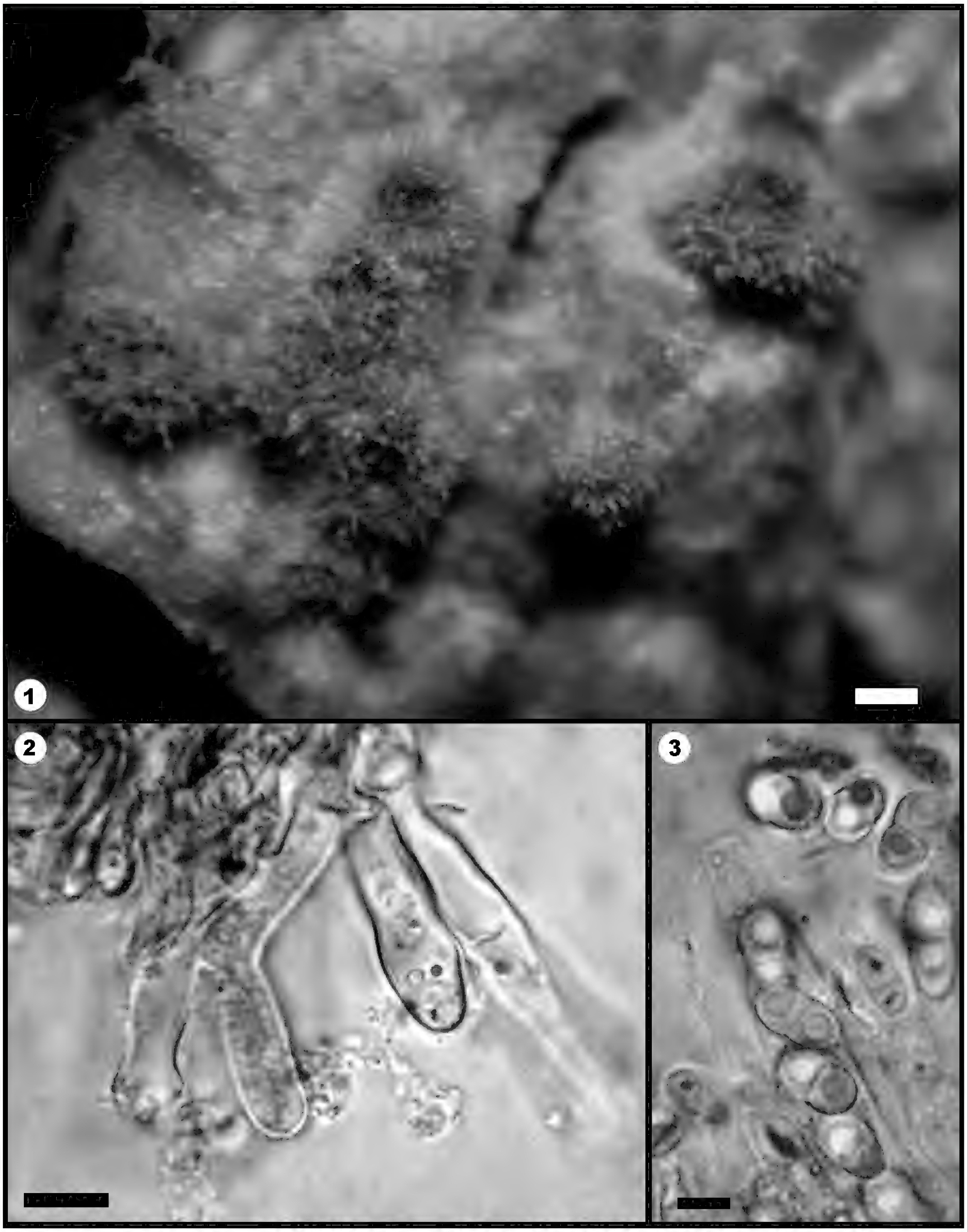

Plate 3. *Nectriopsis hirta* (all from holotype). Figure 1, habitus of the perithecia on *Pertusaria pertusa* thallus (scale = 100 µm). Figure 2, excipular hairs (scale = 10 µm). Figure 3, asci with young ascospores (scale = 10 µm).

(12-18 x 6-8 µm). This species could be fungicolous and associated with *Naetrocymbe saxicola* on stones in streams (Molitor & Diederich 1997). Finally, the habitus of the new species is also similar to the common *N. lecanodes* (Cesati) Diederich & Schoers, but the spores in this species are smaller and narrower (9-12 x 3-4(-8) µm).

ADDITIONAL SPECIMENS EXAMINED. – **SPAIN:** Álava, same locality as type, *J. Etayo 25023* (hb. Etayo); Gipuzkoa, Oieleku, on sterile lichen on *Acer* trunk, 43°14'39"N, 1°49'37"W, 22.viii.2006, *J. Etayo 23425 & J.A. Azpilicueta* (hb. Etayo); Navarra, Sª de Aralar, *Fagus*-wood near the monastery, on *Pertusaria pertusa*, 1300 m, x.2009, *J. Etayo 25363* (hb. Etayo).

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Those determining lichenicolous fungi must rely heavily on a number of regional keys (e.g. Clauzade et al. 1989; Diederich 2004; Hawksworth 1983; Ihen & Wedin 2008). None are a substitute for the technical literature on the genera and species or sure guides for what occurs in other regions. Each covers a number of species not in the other keys, making them all indispensible if you determine lichenicolous fungi. In fact, with the constant description of new species and the proliferation of new records, they become quickly outdated. Krystyna Czyżewska and Martin Kukwa add to this literature a welcome new catalogue and key to the lichenicolous fungi of Poland which covers 216 lichenicolus fungi, 27 lichenicolus lichens, and six slime molds often found on lichens.

The catalogue lists each species for Poland with their hosts and gives references for the reports but no references for taxonomic literature. In the catalogue lichenicolous lichens and slime molds are not clearly delineated, but if you are unfamiliar with the species, it can usually be deduced from the notes.

The key is easy to use. As with all regional keys one must be careful not to be overly influenced by the hosts or to squeeze taxa from other regions too easily into species you are not familiar with. If you are unfamiliar with the species always refer back to the taxonomic literature, taking care to verify ascospore size and other characters which often are finely separated, with an eye open for innovations or controversies in the genus. For instance, outside of Poland, if you determine a specimen as *Endococcus rugulosa* using this key you will not be able to identify *E. rugulosa* s. str. on *Verrucaria.*

The volume concludes with a host list. These are always valuable and should accompany every regional treatment (it is sorely lacking in the *Lichen Flora of the Greater Sonoran Desert Region*). As always, host-based thinking can be dangerous and is no substitute for careful observation of the taxon. It is probably the most common cause of incorrect determinations by lichenologists who identify lichenicolous fungi only occasionally.

Lichenicolous Fungi of Poland is a paperback without any illustrations except two small maps which show that Poland is far from fully explored for lichenicolous fungi. This should be carried by booksellers of mycological and lichenological books soon but there is no price on the book. It is an excellent addition to your personal library if you determine lichenicolous fungi, especially in the northern hemisphere. Czyżewska and Kukwa have done a fine job.

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Opuscula Philolichenum, Index to New Taxa Proposed in Volume No. 8, 2010

NEW TAXA (INCL. MYCOBANK NOS.)

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